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South Carolina Agricultural Experiment Station.

Clemson Agricultural College.

(*S. C. A. & M. COLLEGE.*)

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BROAD AND NARROW TIRES.

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BROAD AND NARROW TIRES ON SAND ROADS

—BY—

C. M. CONNER, Assistant Agriculturist.

SUMMARY.

In all conditions of Sand Roads the draft of the Broad Tire was from 7.49 to 28.6 per cent. less than the Narrow Tire.

There was little difference in the draft of the Broad Tire on wet or dry sand. The Narrow Tire pulls a little more than 5 per cent. lighter in wet sand.

The condition of the road was not improved by the use of the Broad Tire except for Broad Tires.

The draft of the Narrow Tire was 5.73 per cent. less in loose sand than in a well formed rut of the Broad Tire.

At the request of the Board of Control information relating to the use of broad and narrow tires has been collected, using such parts of reports from other States as related to conditions found in South Carolina. But before publishing this information it was thought best to have some tests made on the sand roads of the lower part of the State, as none of the trials reported by other stations, were made on just such roads found throughout the coast region. Here the road bed is of pure sand with no hard surface underneath, so that a wheel will sink almost in proportion to the load.

In making the test a set of metallic wheels of standard height and having six inch tires was used. The narrow tired wheels were of the same height with 1 1-2 inch tires. The load was the same in both cases, viz: 2,000 pounds net. The dynamometer used by the Missouri Experiment Station was borrowed for testing the draft.

The tests were made on a very sandy piece of road about one and one-half miles from Denmark, S. C. There was no clay nearer than two feet of the surface, and the loose sand was worked up by travel to the depth of about eight inches. There are only two conditions to be found on a road like this, namely, wet and dry. So two sets of tests were made, one while the road was dry and one while it was wet.

When the road is dry the narrow tired wheel pushes the sand to either side and sinks until it finds a surface firm enough to bear it up. The dry sand falls back and fills the track, so that each wheel must force the sand out of its way every time it passes along. The broad tire forces a part of the sand to either side and rolls over a part of it. The sand does not fill the track to the same extent as that of the narrow tire because the wheel does not sink as deep and the track is much broader. But even after the broad tire has been run in the same track for a number of times, the sand is pushed forward in the bottom of the track by the broad tire, thus forming a wave of sand in front of each wheel, causing the draft to be much greater than it would be if the loose sand could be made firm enough to prevent this. The sand packs better when wet, but not enough to make any great difference in the draft.

The first test was made Aug. 17, 1899. The sand was very dry, no rain having fallen for more than thirty days. There was loose, dry sand on the surface to the depth of six or eight inches. The narrow tire was run in the track made by travel, the broad tire was run in the same track after the narrow tire. The narrow tire cut in about eight inches and the broad tire about three and one-half inches. The road was nearly level.

	Average draft.
Narrow tire	605 pounds
Broad tire	536 "
Difference in favor of broad tire	69 "
Percentage difference in favor of broad tire	12.87

The second test was made Oct. 3, 1899, two days after a heavy rain. This test was made in the same place as the one mentioned above, hence the conditions were the same, except that the sand was wet. The sand did not fall back in the rut as much as it did when dry. The narrow tired wheels cut in about seven inches, the broad tired wheels formed a rut about three inches deep.

	Average draft.
Narrow tire	574 pounds
Broad tire	534 "
Difference in favor of broad tire	40 "
Percentage difference in favor of broad tire	7.49

It will be noticed that the broad tire pulled lighter than the narrow both on dry and wet sand, but the difference is greater on the dry sand. It will also be noticed that there is very little difference in the draft of the broad tire on the wet and dry sand.

It has been shown by the Missouri tests that the broad tire will improve a clay road. In order to see what effect it would have on the sandy road the broad tired wagon was run five time in the same track and then the draft tested.

	Average draft.
Broad tire, first run	534 pounds
Broad tire, sixth run	472 ”
Difference in favor of sixth run	62 ”
Percentage difference in favor of sixth run	13.13

This shows that after the sand has become level the broad tire passes over it easier than it does when freshly cut up. The broad tire had formed a rut about four inches deep. The depth of the rut increased very little after the first or second run.

The narrow tired wagon was run in the track made by the broad tire to see what condition the road was left in for the narrow tired wagon. The results are as follows:

	Average draft.
Narrow tire, in track of broad tire after sixth run	607 pounds
Broad tire, sixth run	472 ”
Difference in favor of broad tire	135 ”
Percentage difference in favor of broad tire	28.60

The narrow tire cut down about four inches in the rut of the broad tire, the sand being packed made the draft heavier than it was in the loose sand. The above show that if broad tires were in general use a load of 2,572 pounds could be hauled with the same draft required to haul a load of 2,000 on a narrow tired wagon. One run of the narrow tire was sufficient to destroy all trace of the track made by the broad tire.

Acknowledgments.

The Experiment Station wishes to acknowledge the kindness of the Missouri Experiment Station in allowing the use of its dynamometer to make the tests. Also to thank Hon. S. G. Mayfield for the use of wagons, teams and men.

Extracts from the Missouri Tests.

The Missouri Experiment Station carried on a large number of elaborate tests with broad and narrow tires, relative to their use on roads and about the farm. They used the same kind of metallic wheels as was used by this station in making the test on sand roads. Their length of run was from 200 to

600 feet and return, net load, 2,000 pounds; width of tires, 6,41-2 inches. A self-recording dynamometer was used. These tests covered a period of twenty months, so that all conditions of road were found during that time.

Several trials were made on a macadam street, hard, smooth, nearly level and comparatively free from stone or loose sand, where one would suppose that the narrow tire would run the lightest, but a load of 2,714 pounds could have been hauled on the broad tires with the same draft required to haul a load of 2,000 on the narrow tires. On a gravel road, with the surface much like that mentioned above, except that there was more or less loose gravel, a load of 2,482 pounds could have been hauled on the broad tires with the same draft required to haul a load of 2,000 on the narrow tires.

On dirt roads more extensive tests were made, covering all conditions of road throughout the year. The following are some of the tests in detail:

Dirt road, dry, hard, free from ruts and dust, nearly level. Length of run, 400 feet.

	Average draft.
Narrow tires.	137.3 pounds
Broad tires.	104.8 "
Difference in favor of broad tires.	32.5 "
Percentage difference in favor of broad tires. . .	31.0

This piece of road had been worked down by travel so that the conditions presented were about the same as those found on the gravel and macadam roads, and the general results were about the same. The writer of the report, after giving further detailed information, says: "It will be observed that the draft is almost as light on the dirt road in this condition as on the macadam in its best condition and is really less than on the gravel road in any condition in which the trials were made. On dry dirt roads the draft required to haul a 2,000 pound load with narrow tired wheels was capable of drawing 2,620 in the first trial, on the broad tired wheels."

After the dust had been worked up two or three inches deep, leaving a hard, smooth roadbed underneath, another trial was made, in which the narrow tire pulls sixteen pounds lighter as an average of two tests. "Here practically the same conditions are presented as in the trials on a gravel road covered with a slush of sand and fine gravel, and in the case of the dirt roads covered with an inch or two of soft mud overlying a stratum of hard earth. The dry, loose, fine dust offered comparatively little resistance to the narrow tired wheels. They practically forced the dust to either side and rolled over the hard, smooth roadbed underneath. The six inch tires, on the other hand, were compelled to roll over this loose dust in which there was not sufficient moisture to enable it to become compacted and firm under them. It is to be noted that the dust was deeper on this road than is found on the ordinary country road, except in times of excessive drought or after excessive use."

The following part of the report will be found interesting and is presented in detail:

Clay road, surface sticky, firm underneath. Fair hauling condition. Ruts four to six inches deep with walls and bottom hard and dry. First run made with narrow tires in original ruts. Broad tires run over narrow tire ruts. Length of run, 400 feet. Trial made Jan. 9, 1897.

	Average draft.
Broad tire	308.0 pounds
Narrow tire	206.1 "
Difference in favor of narrow tire	101.9 "
Percentage difference in favor of narrow tire	49.4

Clay road. Surface soft to a depth of three or four inches. Ruts cut by narrow tires in ordinary use of the road five to six inches deep, with fairly firm bottom. Walls of ruts more or less soft and sticky. The narrow tired wheels were run in these ruts four times without appreciably deepening them. The broad tired wheels were run over the ruts forming a new rut six inches wide and about three and one-half inches deep in the soft clay on the surface. Trial made Jan. 16, 1897.

	Average draft. 1st. run.	Average draft. 2d. run.	Average of both.
Broad tires	490.8	382.0	436.4
Narrow tires	340.1	330.0	335.0
Difference in favor of narrow tires	150.7	52.0	101.4
Percentage difference	44.3	15.8	30.3

It will be observed that in the second run of the broad tired wheels in their own rut the draft was materially reduced, the difference between the broad and narrow tires being but 52.0 pounds, or 15.8 per cent. as compared with a difference of 150.7 pounds, or 44.3 per cent. in the first run. The average draft of the broad tires was:

	First run.	Second run.
Going	560.8 pounds	384.0 pounds
Returning	420.8 "	380.0 "
Average	490.8 "	382.0 "

A difference in the average of the two runs of 108.8 pounds. A rain interrupted the experiment at this point and prevented further tests of the broad tires in their own ruts. In every trial on a soft surface overlying a hard roadbed, the narrow tires show to an advantage. This advantage reaches its maximum when the soft covering of the road consists of sticky clay. Such a condition is met frequently for short periods in the spring, summer and fall, immediately after rain has fallen on a hard, dry road. As explained in the case of the wet gravel road and dusty dirt road, this difference appears to be due to the fact that the narrow tires cut through the mud and roll on the hard roadbed underneath with very much less resistance than is encountered by the broad tires. In the nature of the case, the condition of the road is of short duration. A few hours of sun will sufficiently dry this mud or sand so that it will pack under the broad tires instead of being pushed aside. In that condition the narrow tire is at its greatest disadvantage, as compared with the broad tire, as is clearly shown in the next trial on a dirt road drying on top.

Clay road, mud deep, stiff and beginning to dry on the surface. At one end of the run was soft mud on which water was standing. The narrow tire made a rut seven inches deep. Length of run, 400 feet.

	Average draft.
Narrow tires	825.3 pounds
Broad tires	551.9 ”
Difference in favor of broad tires	273.4 ”
Percentage difference in favor of broad tires	49.3

Clay road, muddy, slightly frozen on top, but not enough to bear the load on either set of wheels. Narrow tires made ruts 12 inches deep in places. Length of run, 400 feet.

	Average draft.
Narrow tires	549.0 pounds
Broad tires	447.6 ”
Difference in favor of broad tires	101.4 ”
Percentage difference in favor of broad tires	22.0

After completing nine trials on roads embracing the different conditions of surface, from mud, deep, stiff and just beginning to dry on the surface, to dry on top and spongy underneath, the writer of the report says: “The draft of the broad tired wagon was very much less than that of the narrow tired wagon. The maximum advantage of the broad tire in this condition of road is shown when the surface is dry enough to allow the six inch tires to pass over without cutting a rut, but not stiff enough to prevent the narrow tires from sinking through the surface and cutting a rut. In this condition of the road the difference amounted to from 52 to 61 per cent. The ordinary country roads are found in this condition during a very much larger number of days in the year than they are found in the condition described in the preceding section, viz: wet and sloppy, or sticky on top and firm underneath. The difference in the draft of the broad and narrow tires is greater on this condition of roads than when the roads are either harder or softer. As the road dries and becomes firmer, the difference gradually diminishes until it reaches about 25 to 30 per cent., in the case of dry, hard and smooth dirt, gravel or macadam roads, as has already been shown. The country roads do not appear to get in a condition good enough, however, to completely eliminate the difference in favor of the broad tire. On the other hand, as the mud becomes softer and deeper, the difference between the draft of the broad and narrow tires rapidly diminishes until a condition is found where the narrow tires will draw considerably easier than the broad tires. This is especially true when the mud is deep and sticky, as in stiff clay soils, so that both sets of wheels cut deep ruts. Occasionally a road will be in such a condition that the mud will adhere to the wheels of both broad and narrow tired wagons. In that condition the narrow tire shows to its greatest advantage, when compared with the broad tire. It should be borne in mind, however, that this condition of road is of short duration and comparatively rare. It is also true that the roads are in this condition at a season of the year when comparatively little freighting is done, and when the use of the road has been naturally reduced to its minimum."

In introducing the broad tire one of the most serious objections will be the disadvantage it is supposed to be placed in when required to run over the ruts made by the narrow tire. To ascertain to what extent ruts would influence the draft of the broad tired wagon and to approximate, if possible, the proportion of vehicles that would be required to use broad tires in order to eliminate this difficulty, a large number of tests was made. In summing up the whole matter the writer of the report says: "These results clearly show that on two very common conditions of the road, the very two conditions in which the user of the broad tire is supposed to be placed at a very serious disadvantage on account of the fact that a majority of the freighting wagons use narrow tires, the draft is uniformly reduced for both broad and narrow tired wagons, if something like half of the loaded wagons passing over the road have wide tires. They further show that beginning even with deep ruts, after the first run of the broad tires, the user of the broad tire will be able to haul a given load with considerable less draft than will the user of the narrow tire. Apparently, therefore, the ruts made by the narrow tires are not the serious obstacle to the adoption of the broad tires that they have been believed to be. Besides these ruts would not have been formed had a reasonable proportion of loaded wagons had six inch tires in the beginning."

The Broad Tire on the Farm.

A large number of tests was made to show the value of the broad tire on the farm and such parts as are of interest are quoted entire.

"Five runs were made on bluegrass pastures covering different conditions of surface with the same general result. The same principle holds good here that applies to meadows and to any surface that is more or less firmly bound together by roots of grass or weeds, viz: That where the bearing surface of the wheel is large these roots tend to keep the wheel on the surface, prevent ruts being cut and, therefore, materially reduce the draft. This is also true to a less degree of a surface covered with loose grass or other rubbish.

The difference in draft in favor of the broad tires in the runs on bluegrass sod varies from 26.5 per cent. on a hard, dry, smooth surface to 89.7 per cent. on a soft surface. Averaging all the trials on pasture lands, we find a saving in draft amounting to 116.4 pounds, or 45.7 per cent., due to the broad tires. Therefore, with the same effort required to draw one ton on the narrow tires over pasture land in these trials, a load of 2,914 pounds could have been drawn on the broad tires.

Stubble land, grown in cowpeas the previous year; ground soft. Narrow tires cut ruts fourteen inches deep first run. Broad tires cut rut about three to four inches deep. Four horses were required to pull the narrow tired wagon. Length of run, 400 feet. Trial made Feb. 8, 1896.

	Average draft.
Narrow tires..	758.1 pounds
Broad tires..	538.7 "
Difference in favor of broad tires..	219.4 "
Percentage difference..	40.0

Wheat stubble, dry, smooth and comparatively free from weeds. Neither set of wheels made appreciable ruts. Length of run, 400 feet. Trial made Sept. 12, 1896.

	Average draft.	
Narrow tires	298.5	pounds
Broad tires	222.0	"
Difference in favor of broad tires	76.5	"
Percentage difference	34.4	

Corn stubble, free from weeds; nearly dry enough to plow. Surface smooth and nearly level. Length of run, 400 feet. Trial made March 27, 1896.

	Average draft.	
Narrow tires	484.2	pounds
Broad tires	325.7	"
Difference in favor of broad tires	158.5	"
Percentage difference	48.0	

Corn land, dry enough to plow. Surface covered with dead grass and stalks; almost level. Length of run, 400 feet. Trial made March 27, 1896.

	Average draft.	
Narrow tires	422.7	pounds
Broad tires	361.9	"
Difference in favor of broad tires	60.8	"
Percentage difference	16.8	

Corn stubble in the fall; land dry and reasonably firm. Broad tires made rut one to two and one-half inches deep. Narrow tires made rut two to five and one-half inches deep. Length of run, 400 feet. Trial made Oct. 13, 1896.

	Average draft.	
Narrow tires	472.9	pounds
Broad tires	285.6	"
Difference in favor of broad tires	187.3	"
Percentage difference	65.5	

Corn stubble nearly dry enough to plow and almost free from weeds and trash. Ruts made by narrow tires 5.6 inches deep; ruts made by broad tires 1.45 inches deep. Length of run, 400 feet. Trial made March 20, 1897.

	Average draft.
Narrow tires	878.4 pounds
Broad tires	509.9 "
Difference in favor of broad tires	368.5 "
Percentage difference	72.2

Eight separate trials were made on stubble land, embracing wet, medium and dry conditions. These trials include both wheat and corn stubble land. The results in every case are strikingly favorable to the broad tire. The difference varies from 16.8 to 72 per cent. The average difference for all the trials is 186.2 pounds, or 48.5 per cent. With the same effort, therefore required to haul a ton over the corn fields, wheat stubble, etc., of the farm on narrow tires, a load of 2,970 pounds could have been hauled on the broad tires; this, too, without doing any preceptible damage to the fields.

Plowed ground; not harrowed; many large clods; surface rough; large clods crushed by wide tires. narrow tires pushed them aside. Trial made Sept. 12, 1896.

	Average draft.
Narrow tires	509.9 pounds
Broad tires	382.6 "
Difference in favor of broad tires	127.3 "
Percentage difference	33.2

Same as above, except ground prepared for seeding. Surface smooth; fairly compact; fine tilth.

	Average draft.
Narrow tires	466.5 pounds
Broad tires	323.0 "
Difference in favor of broad tires	143.3 "
Percentage difference	44.3

Two trials were made on plowed fields, one over freshly plowed ground before the clods had been reduced by tillage; the second on the same ground after it had been reduced to a fine tilth as for seeding. In the first trial on the freshly plowed ground, the difference in favor of the broad tire was 127.3

pounds, or 32.2 per cent., practically one-third less than the narrow tire. In the second trial the difference was 143.3 pounds, or 44.3 per cent. in favor of the broad tire.

In short, in every trial on the farm, whether in the meadow, pasture, stubble or plowed field, the draft was materially lessened by the use of the broad tires. The protection to the fields and meadows and pastures afforded by the broad tires in itself ought to be sufficient reason for their immediate adoption, but when from one-third to one-half the draft can be saved at the same time, there remains no reasonable excuse for the continued use of the narrow tires. As fast as the narrow tired wheels owned by the farmers wear out, they should be replaced, without exception, by the broad tired wheels. Disregarding the benefits to the public highways arising from the use of the broad tires, and also the benefits to the user of the broad tires in the saving of draft on the public roads, it would be profitable to every farmer to have broad tired wagons, if for no other use than on his farm."

Experiments Reported by the Michigan Experiment Station.

These tests were made with one and five-eighth and four inch tires. The load was 4,500 pounds, including wagon.

The first trial was made on a hard,dry gravel road. The draft of the narrow tire was 151 pounds and the wide tire 141, a difference of ten pounds in favor of the broad tire.

One trial was made on a sandy road. The loose sand on the surface was about two inches deep, resting on a rather uneven soft surface. The draft of the narrow tire was 263 pounds, and the broad tire 217 pounds, a difference of 46 pounds in favor of the broad tire.

In the trials made on grass sod the results were about the same as those reported by the Missouri Station. On bluegrass sod the draft of the narrow tire was 334 pounds and the broad tire 256 pounds, a difference of 78 pounds, or 23.35 per cent. in favor of the broad tire. On a clover and timothy sod the draft of the narrow tire was 590 pounds and the broad tire

430 pounds, 160 pounds or 27.11 per cent less than the power required to draw the narrow tired wagon.

The trial made on corn stubble shows the draft of the narrow tire to be 731 pounds, as compared with 491 pounds for the broad tire, making a difference of 240 pounds, or 32.83 per cent.

All these results favor the wide tires.

Summary of Experiments Made.

Experiments at the Utah Experiment Station demonstrated that a given load on one and one-half inch tire drew about 40 per cent. heavier than when on a three inch tire, the draft being on a fairly stiff grass sod. On a moist but hard road the one and one-half inch tire drew 12.7 per cent. heavier than the three inch.

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South Carolina
Agricultural Experiment Station
OF
Clemson Agricultural College.

Strawberries.

C. C. NEWMAN.

CLEMSON COLLEGE, S. C.

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STRAWBERRIES.

C. C. Newman.

So many inquiries have been received at this office as to the best varieties and methods of culture of strawberries, it was thought well to publish the notes taken on ninety-five varieties tested at this station this year.

Sexuality.

In many cases growers have complained that the varieties they grow are not productive, although they bloom profusely. This is easily explained and the remedy applied. The essential organs of reproduction are the *pistils* or female organs and the *stamens* or male organs. These organs are usually found in the same flowers, but there are many varieties of strawberries that produce flowers with only the *pistil* or female organ.

When both male and female organs are found in the same flower it is called perfect, or "bi-sexual," and when the female organ is found only, the flower is called imperfect or "*pistillate.*"

The object of the plant is to produce seed and fruit in order to reproduce itself.

If an imperfect or pistillate variety be isolated from all perfect or *bi-sexual* flowering plants, it can produce no fruit, for it is necessary that the pollen from the perfect flower be transferred to the pistil of the imperfect flower before the latter can produce fruit.

In planting a field in pistillate varieties it is necessary therefore that a perfect variety be planted in every fifth row to pollenize the imperfect flowers of the pistillate variety. The pollen will be transferred by bees and other agencies from the one to the other and make the pistillate variety productive.

Soil.

While the strawberry does well on a sandy or a well drained clay soil, it thrives best on a good combination of clay and sand.

Preparation of the Soil.

The strawberry crop is usually cut off about one-third by a drouth coming just at the time the rain is most needed.

The land should be sub-soiled about fourteen inches deep before planting, and harrowed until in good condition. This thorough preparation and deepening of the soil with continued shallow cultivation tends to hold the moisture during a drouth and gives better drainage in wet seasons.

Methods of Planting and Cultivation.

Strawberries should be planted in October or November or early in March. Best results will be obtained from the fall planting and a small crop will be produced the first season.

Hill Culture—Rows should be three feet apart and plants set fourteen inches in the row. All runners must be kept cut off and the plants cultivated shallow and kept in single crowns.

By this method the largest and most perfect berries can be produced which will always bring the best market price.

The bed should be renewed every second year, either by setting new plants or by allowing the runners to take root between the old plants, removing the latter as soon as the former become well established.

Matted Rows—This method is in most common use and gives good results. The plants are set in the same way as in the hill culture, but instead of cutting off the runners, they are encouraged to take root in the row and form a "matted bed."

They are cultivated shallow as in hill culture with the plow, but the rows soon become so matted that the hoe cannot be used in the row.

A very large yield can be had in this way, but the fruit will average much smaller than in hill culture.

Mulching.

The most satisfactory method yet practiced for home use is as follows:

Rows should be two feet apart and the plants set eighteen inches in the row. The bed is then covered with a good mulch of leaves, pine straw or grain straw. This keeps the soil moist and mellow and no further cultivation is necessary where the ground has been thoroughly prepared before planting. It is necessary, however to go over occasionally and pull up by hand any weeds that may find their way through the mulch.

Where the mulch is drawn well around the plant few runners will take root, but care should be taken to cut them off before the little plant is formed at the end.

A bed kept by the above method will often continue in bearing from one to two weeks longer than one cultivated in the ordinary way. The mulch keeps the berries clean of sand and dirt, which is a very important point in its favor. Often after a rain the berries will be so soiled that it is necessary to wash them before marketing. This, of course, injures them more or less by making them more liable to decay. This is never necessary where the plants have been properly mulched.

Taking everything into consideration this has proven to be by far the most satisfactory method with us for home use.

Varieties.

The following varieties were the first to ripen fruit:

Excelsior, Hoffman, Michel, Meeks Early, Ideal, Lady Thompson, Sweetzers Early, and Westbrook.

The following were the last to stop bearing:

Gandy, Margaret, Haverland, Holland, Mid-Summer, Oriole, Shuckless, Kentucky, Great Pacific, Gardner, Glen-Mary and Gandy Belle.

With us the following six varieties have proved to be the best all-round berries out of ninety-five varieties tested:

Haverland, Brandy Wine, West Lawn, Lady Thompson, Bismarck and Bubach.

Haverland P. Ripens between the 3d and 6th of May and continues to bear abundantly until the 4th of June. Berries very large, long and pointed, very attractive, but do not ripen up as uniformly as the other five varieties mentioned below. Quality very good, firm. Vines, vigorous.

Brandy Wine B. Ripens between the 3d and 6th May and continues to bear until last of May. Berries ripen very uniformly and are very large, regular and conical. Very attractive, quality very good but slightly acid. Vines vigorous and very productive.

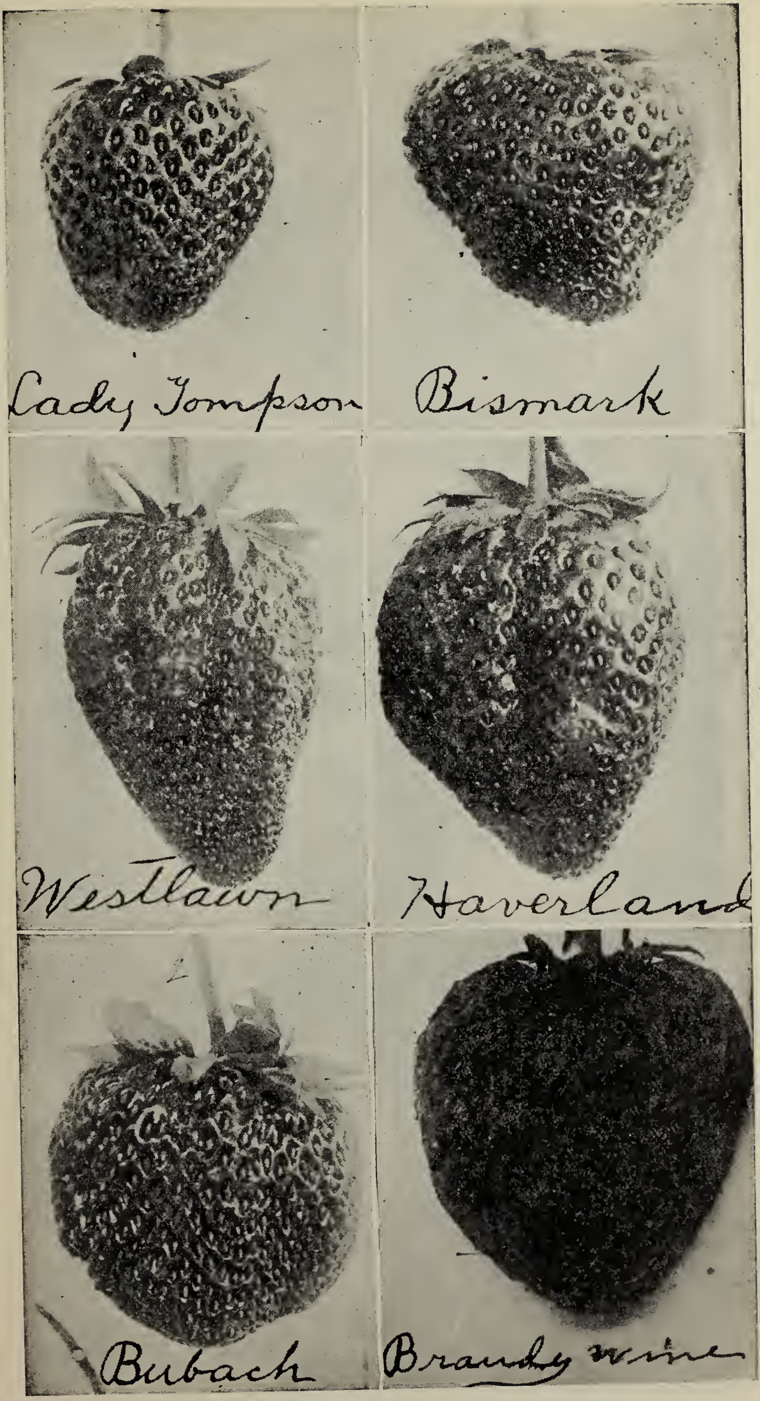
Lady Thompson B. Ripens between the 1st and 3d of May and continues to bear uniformly large berries until May 19th to 21st. This is the most productive variety tested. Berries nearly all the same size and very regular in shape. Quality good; fruit very firm; vines very vigorous.

West Lawn P. Ripens between the 6th and 8th of May and continues to bear very large and handsome fruit until the 25th of May. Berries ripen uniformly; are very regular in shape; quality very good; vines very vigorous and productive.

Bismark B. Ripens the 5th of May and continues to bear enormous berries until May 19th. Berries mostly from double flowers, making them irregular in shape; fruit does not ripen up as uniformly as the above mentioned varieties; quality good; very large and showy; very productive and vigorous.

Bubach P. Ripens May 4th and continues to bear handsome fruit until the 19th of May; quality good; plants vigorous and productive.

PLATE I.



In Plates 1, 2, 3, 4 and 5 berries are natural size.

PLATE II.

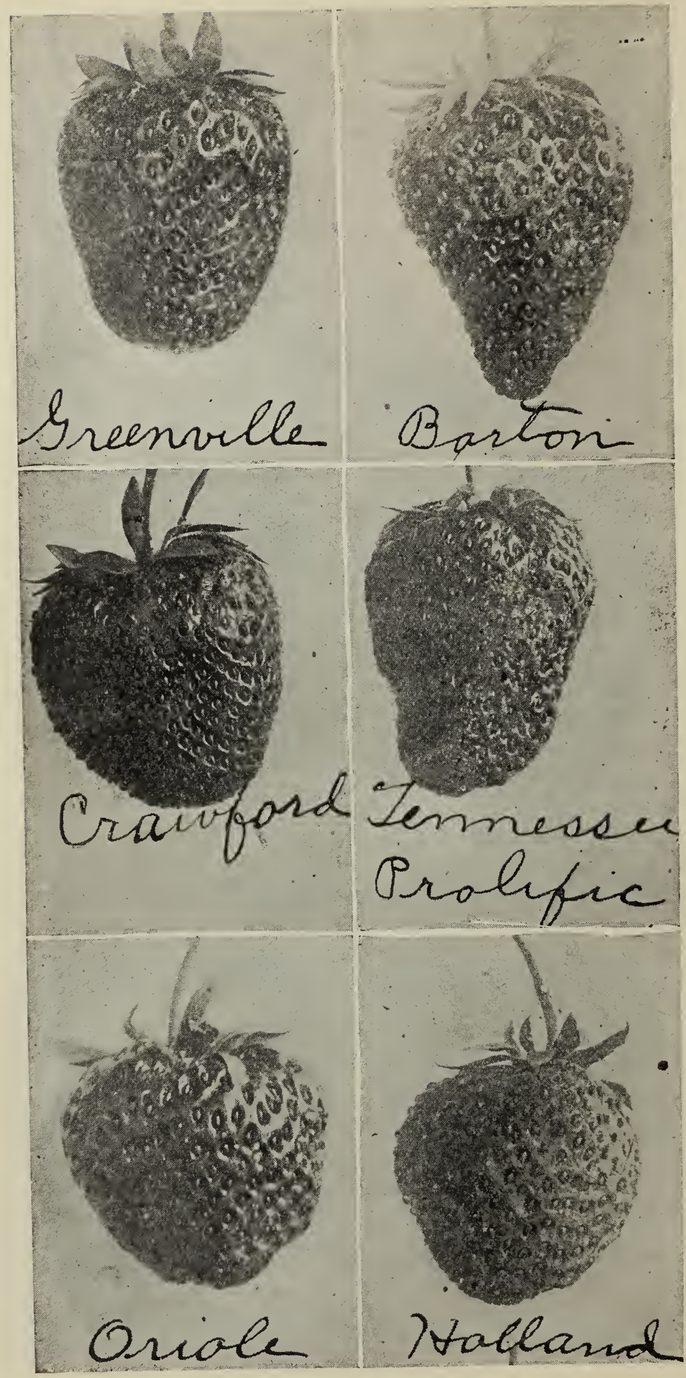
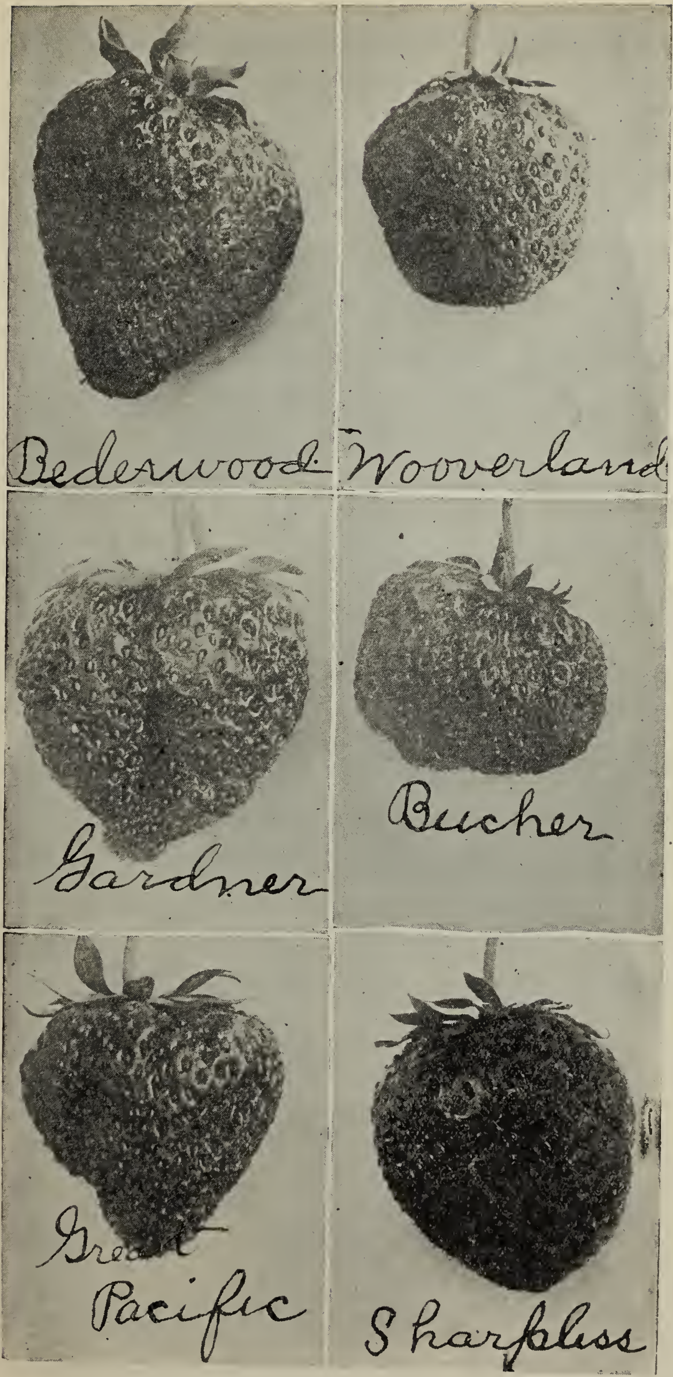

Greenville
Barton
Crawford
Tennessee Prolific
Oriole
Holland

PLATE III.



"Wooverland" should read "Wolverton."

PLATE IV.

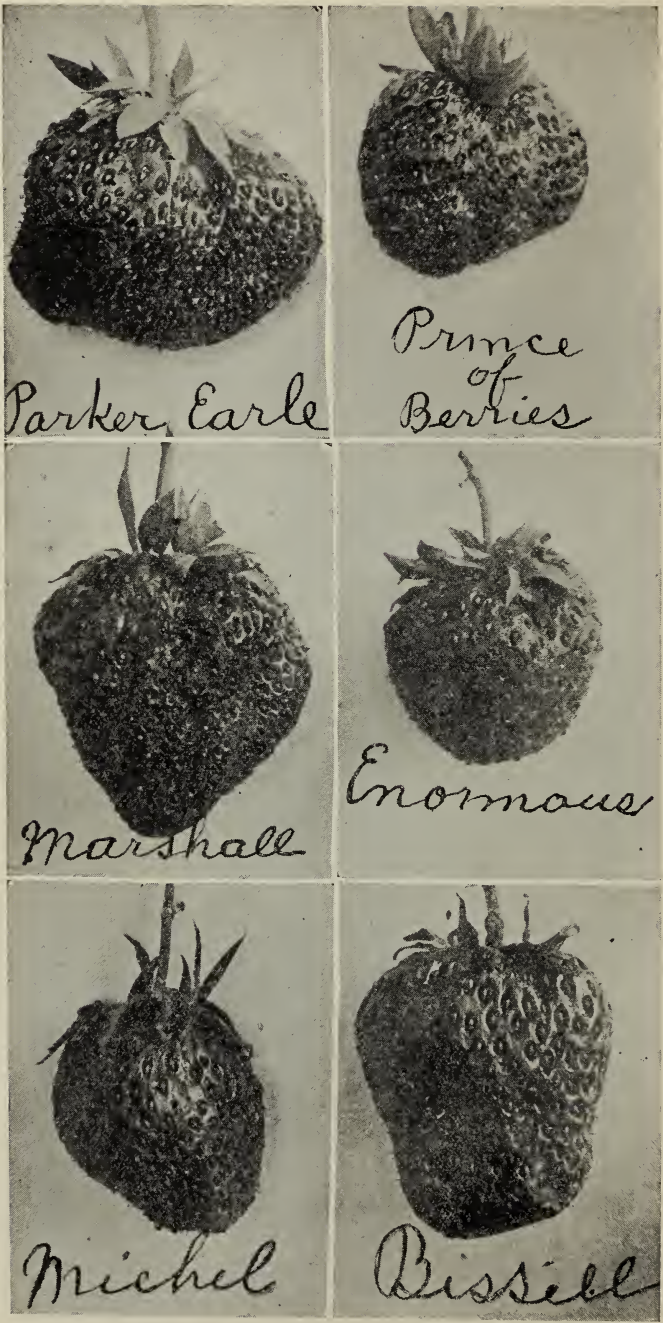
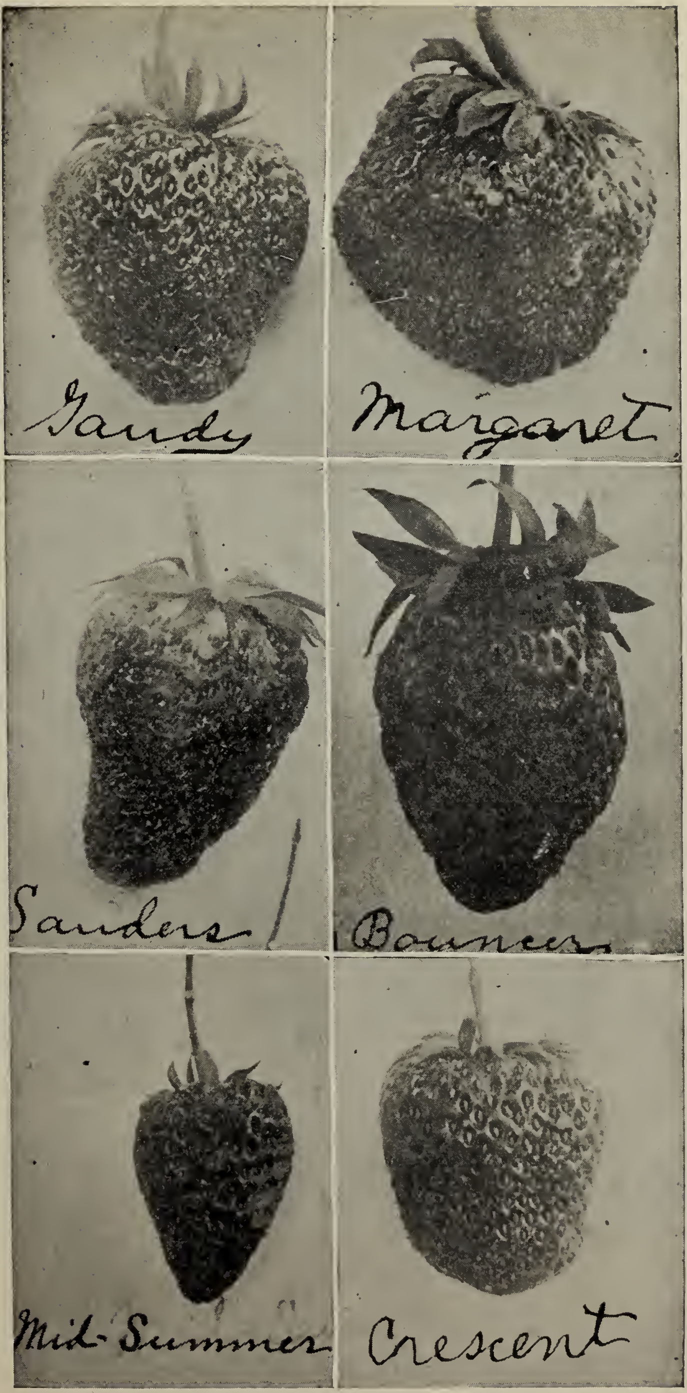

Parker Earle
Prince of Berries
Marshall
Enormous
Michel
Bissell

PLATE V.

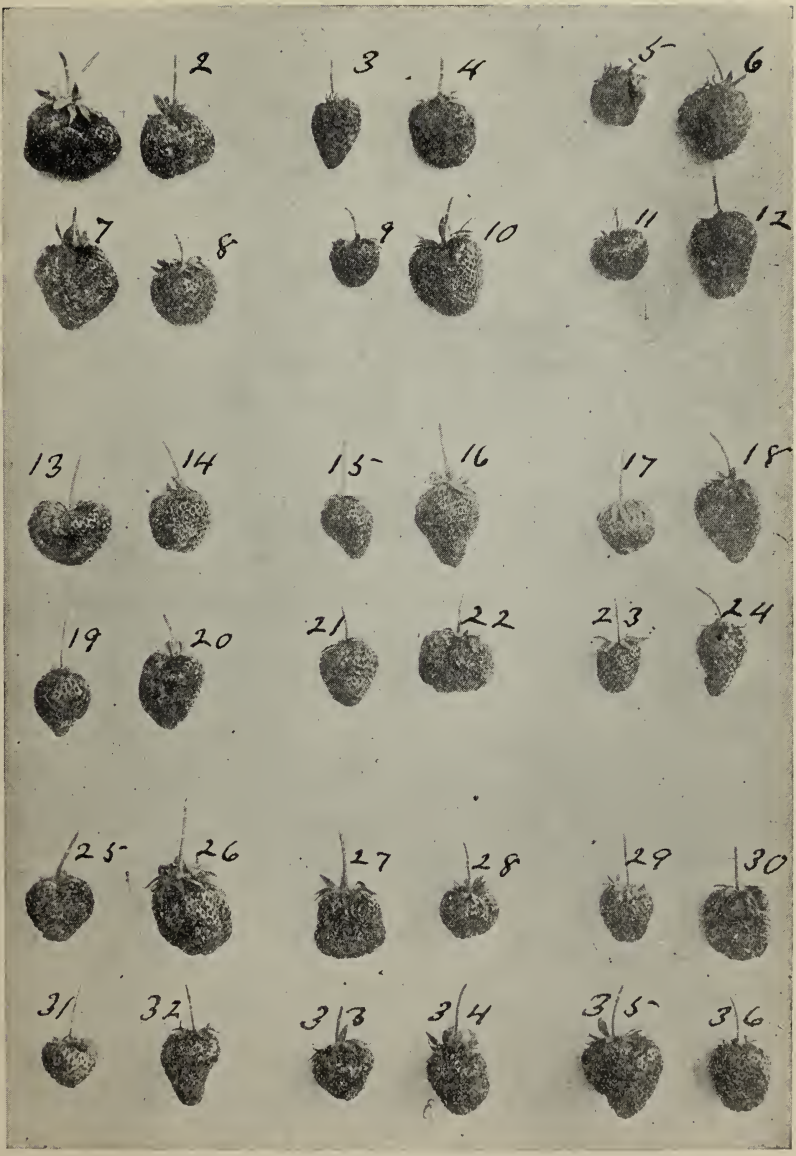


The following varieties have done well here and are worthy of special mention, and attention is called to the good record they bear in the following table:

Greenville B.
Barton P.
Crawford B.
Holland B.
Wolverton B.
Beecher B.
Great Pacific P.
Prince of Berries B.
Enormous P.
Bissell P.
Margaret B.
Bouncer B.
Saunders B.
Tennessee Prolific B.
Oriole B.
Beder Wood B.
Gardner B.
Sharpless B.
Parker Earle B.
Marshall B.
Michel B.
Gandy B.
Crescent P.
Mid-Summer B.

Other varieties tested but not mentioned in any of the above lists have not done well her and cannot be recommended for this locality, while in other localities and under different climatic conditions some that are worthless here may give satisfactory results.

PLATE VI.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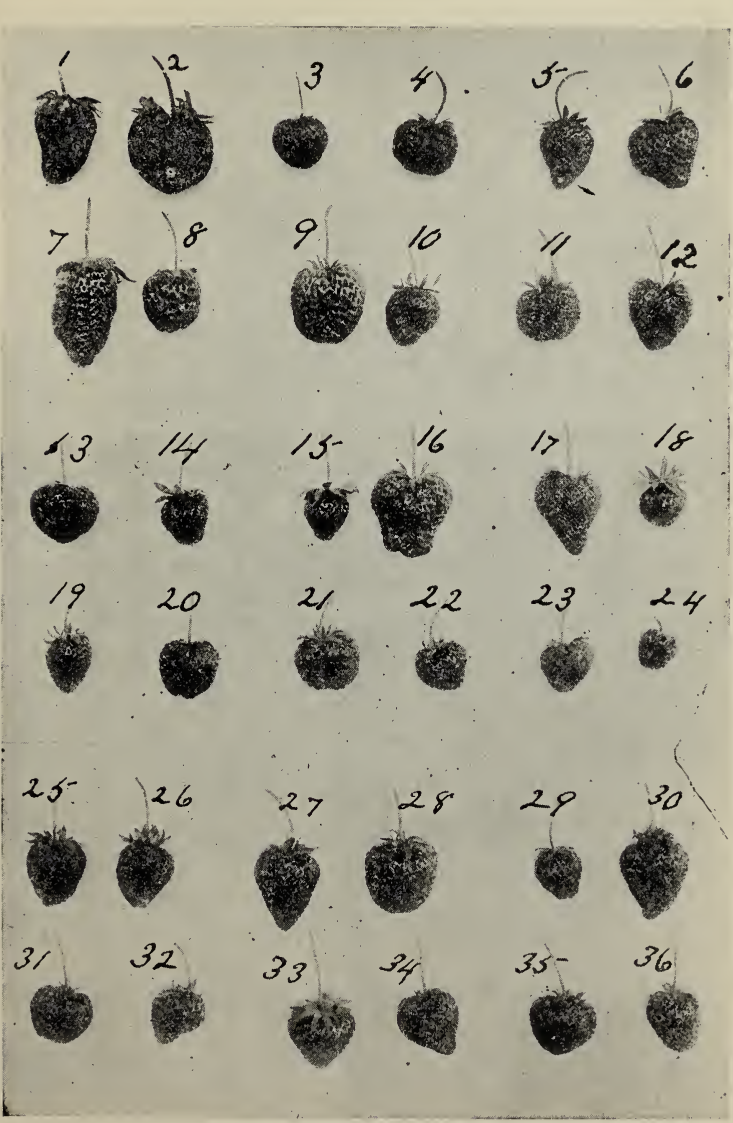
1. Parker Early B.
2. Prince of Berries B.
3. Mid-Summer B.
4. Margaret B.
5. Rio B.
6. Holland B.
7. Marshall B.
8. Enormous P.
9. Indian River B.
10. Crawford B.
11. Middleford P.
12. Tennessee Prolific B.
13. Orange County B.
14. Beverly B.
15. Belle B.
16. Phillips B.
17. Sweetzer's Early B.
18. Saunders B.
19. Louise P.
20. Hoovey B.
21. Muskingum B.
22. Beecher B.
23. Cyclone B.
24. Dayton B.
25. Shuckless B.
26. Bouncer B.
27. Seoford P.
28. Wilson B.
29. Wm. Belt B.
30. Van Demon B.
31. DuPre B.
32. Lovett B.
33. Ideal B.
34. Eureka P.
35. Great Pacific P.
36. Gertrude B.

PLATE VII.



In Plates 6 and 7 berries are reduced very much in size.

1. Saunders B.
2. Brandy Wine B.
3. Westbrook P.
4. Arkansas Traveler B.
5. Van Demon B.
6. Darling B.
7. Haverland P.
8. Hoffman B.
9. Bubach P.
10. Lenah B.
11. Cloud P.
12. Crescent P.
13. Staples B.
14. Columbia B.
15. Imp. Newnan B.
16. Kentucky B.
17. Aroma B.
18. Rio B.
19. Crawford B.
20. Marshall B.
21. Enormous P.
22. Wilson B.
23. Cyclone B.
24. Middleford P.
25. Bissell P.
26. Eureka P.
27. Hoovey B.
28. Holland B.
29. Phenomenal B.
30. Phillips B.
31. Beecher B.
32. Meeks Early B.
33. Ivanhoe B.
34. Eleanor B.
35. Charles Downing B.
36. Princess P.

The cuts in this bulletin were made from photographs taken for us by Prof. C. M. Conner of this station.

EXPLANATION OF TABLE.

In the following table under the "Sex" column "B" indicates bi-sexual or perfect flowered plants, and "P" indicates pistillate or imperfect flowering.

In the columns headed Productiveness, Size, Vigor of Plants, Quality, and Firmness, the grading is indicated by numbers which range from 10 to 0, the former number meaning perfect.

NAME.	Productiveness.	Size of Fruit.	First Ripe.	Last Ripe.	Second Crop.	Vigor of Plants.	Rust.	Quality.	Firmness.	Sex.
Aroma	7	8	May 7	May 25	None	7	None	8	9	B
Arkansaw Traveller	7	8	" 5	" 19	"	9	Little	8	8	B
Bailey's Giant	8	9	" 19	June 2	"	7	"	6	9	P
Barton	9	9	" 6	May 30	"	9	"	8	8	P
Beder Wood	7	8	" 1	" 26	Medium	7	Bad	7	8	B
Beecher	7	9	" 6	" 20	None	9	"	9	9	B
Belle	7	7	" 5	" 20	"	7	V'ry Bad	8	9	B
Bismark	10	10	" 5	" 19	"	8	Little	9	10	B
Bissell	9	8	" 5	" 20	"	9	Bad	9	8	P
Bouncer	8	9	" 7	" 19	"	10	Little	9	9	B
Brandywine	10	9	" 5	" 30	"	10	"	10	7	B
Bubach	10	10	" 4	" 19	"	9	"	9	10	P
Chas. Downing	7	7	" 5	" 19	"	8	V'ry Bad	9	8	B
Cloud	9	8	" 3	" 20	"	8	Little	8	8	P
Clyde	8	8	" 5	" 22	"	8	None	9	9	B
Columbia	7	7	" 6	" 25	"	8	Little	8	8	B
Crawford	7	7	" 7	" 22	"	9	Bad	8	8	B
Crescent	8	8	" 3	" 31	"	9	None	9	10	P
Cyclone	8	7	" 4	" 20	Small	8	Little	8	9	B
Darling	7	8	" 1	" 19	Good	9	None	9	8	B
Dayton	7	8	" 6	" 19	None	8	Little	8	7	B
DuPre	9	7	" 10	June 3	"	10	Bad	7	8	B
Edith	7	8	" 9	May 30	"	7	Little	8	8	P
Eleanor	8	8	" 4	" 27	"	7	"	8	9	B
Enhance	8	9	" 6	" 30	Small	10	"	9	9	B
Enormous	8	9	" 5	" 22	None	9	"	9	10	P
Equinox	8	7	" 4	" 30	"	7	Bad	8	8	B
Eureka	8	6	" 7	" 25	"	8	V'ry Bad	9	8	P
Gandy	9	8	" 4	June 5	"	7	Little	9	9	B
Gandy Belle	8	8	" 5	May 27	"	10	Bad	9	9	B
Gardner	9	9	" 4	" 24	"	10	"	8	9	B
Gertrude	7	7	" 7	" 24	"	8	None	7	8	B
Glen-Mary	9	9	" 6	" 24	"	9	Bad	9	9	P
Great Pacific	9	8	" 5	" 25	"	8	Little	7	10	P
Greenville	8	9	" 6	" 18	"	8	None	8	9	B
Hall's Favorite	8	9	" 3	" 19	"	8	Little	9	8	B
Haverland	10	10	" 6	June 4	"	9	None	9	10	P
Hoffman	9	8	Apr 29	May 25	"	9	Little	9	8	B
Holland	9	8	May 6	" 24	"	9	Bad	8	9	B
Hooey	7	7	" 2	" 19	"	9	Little	8	8	B
Howard	9	7	" 5	" 19	"	9	Bad	7	9	B
Howell	8	9	" 5	" 25	"	9	Little	8	8	B
Ideal	6	7	" 1	" 29	Small	9	"	9	9	B
Improved Newnan	8	5	" 4	" 25	None	8	Bad	7	8	B
Indian River	7	6	" 6	" 17	"	8	None	7	7	B
Ivanhoe	8	8	" 6	" 27	"	7	"	8	9	B
Kentucky	8	8	" 5	" 31	"	9	Bad	9	9	B
Lady Thompson	10	9	" 2	" 19	"	10	None	8	10	B
Lanah	8	8	" 4	" 24	"	9	"	8	7	B
Louise	6	7	" 8	" 19	"	8	Little	7	8	P
Lovett	7	8	" 7	" 25	"	8	"	8	8	B
Margaret	9	9	" 9	June 3	"	7	"	9	9	B
Marshall	7	9	" 8	May 20	"	8	Bad	8	9	B
Meeks' Early	5	5	Apr 27	" 17	"	6	None	9	8	B
Michel	6	6	" 27	" 19	"	9	"	8	8	B

NAME.	Productiveness.	Size of Fruit.	First Ripe.	Last Ripe.	Second Crop.	Vigor of Plants.	Rust.	Quality.	Firmness.	Sex.
Mid-Summer	8	8	May 6	Jun 23	Good	8	Bad	8	9	B
Middlefield	7	8	" 5	May 22	None	7	Little	9	8	P
Muskingum.	8	7	" 6	June 3	"	8	Bad	8	9	B
Murray's Extra	9	8	" 2	May 24	"	9	Little	9	9	B
Ocean City	8	9	" 6	" 27	"	9	None	8	9	B
Orange County	9	8	" 7	" 25	"	8	Little	8	8	B
Oriole	9	8	" 3	" 26	"	7	"	10	7	B
Parker Earle	8	7	" 5	" 20	"	7	Bad	9	8	B
Phenomenal	7	7	May 3	May 26	None	7	Little	8	9	B
Phillips	8	8	" 5	" 19	"	8	Bad	8	9	B
Plow City	8	7	" 7	" 24	"	7	"	8	8	B
Princess	8	9	" 5	" 16	"	7	None	8	9	P
Prince of Berries	9	8	" 6	" 20	"	9	Bad	9	9	B
Princeton Chief	7	8	" 7	" 25	"	8	Little	8	8	P
Rio	7	7	" 3	" 17	"	8	Bad	7	8	B
Saunders	9	8	" 6	" 24	"	9	"	8	9	B
Seaford	9	9	" 6	" 20	"	9	Little	8	8	P
Sharpless	7	9	" 6	" 20	"	7	"	9	9	B
Shuster's Gem	7	9	" 4	" 20	Good	9	"	9	9	P
Shuckless	8	8	" 7	June 5	None	9	Bad	9	8	B
Sweetzer's Early	7	7	Apr. 29	May 17	"	9	"	9	8	B
Splendid	8	8	May 5	June 9	"	7	Little	8	9	B
Staples	7	7	" 3	May 25	"	7	None	8	8	B
Tennessee Prolific,	9	9	" 5	" 25	"	9	Little	8	9	B
Timbrell	7	7	" 9	" 17	Small	8	"	7	8	P
Tubbs	9	7	" 7	" 19	None	7	Bad	8	9	B
Van Demon	7	8	" 6	" 23	"	8	Little	8	8	B
Warfield	9	8	" 4	" 25	"	9	"	10	9	P
Westbrook	8	8	Apr. 29	" 25	"	9	"	9	9	P
West Lawn	9	10	May 7	" 24	"	10	"	10	9	P
Wilson	9	8	" 5	" 27	"	9	Bad	8	9	B
Wm. Belt	8	8	" 7	" 31	"	10	"	9	9	B
Wolverton	8	9	" 5	" 22	"	5	Little	8	9	B

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BULLETIN 52. APRIL, 1900.

South Carolina Agricultural Experiment Station.

Clemson Agricultural College.

(S. C. A. & M. COLLEGE.)

PIG FEEDING.

Address all communications to

S. C. EXPERIMENT STATION, Clemson College, S. C.
Freight and Express Office: Calhoun, S. C.
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Pig Feeding.

J. S. NEWMAN AND J. S. PICKETT.

Object.—To compare the effects of feeding exclusively upon three especial hog crops, ground peas, sweet potatoes and field peas, with corn as a standard.

Plan.—There were four pens and three pigs in each pen. Two of these in each pen were 7-8 Berkshires, one sow and one barrow. The third in each pen was a grade Jersey Red barrow. The Berkshires were from the same litter and eight months old at the beginning of the experiment. The grades were eleven months, all four of the same litter.

They were fed as follows:

Pen No. 1 exclusively upon ground peas.

Pen No. 2 upon sweet potatoes.

Pen No. 3 upon field peas.

Pen No. 4 upon corn.

They were given in each case all they would eat, without waste. Each pig was weighed weekly until the last period, which was thirteen days. In the following table the main facts are presented. In the different pens No. 1 was a grade Berkshire open sow; No. 2, grade Berkshire barrow; No. 3, grade Jersey Red barrow. The first column contains the weights at the beginning of the experiment, Nov. 23rd:

TABLE NO. 1.—Weights by Periods.

PEN NO.	HOG	1ST PERIOD	2ND PERIOD	3RD PERIOD	4TH PERIOD	5TH PERIOD	6TH PERIOD	TOTAL GAIN	TOTAL GAIN PER PEN
1	1. Sow	117	130	133.5	136	147	151	34	151
	2. Barrow	136	150.5	158	162	174.5	189	53	
	3. Barrow	176	192.5	204.5	206	226	240	64	
2	1. Sow	128	130.5	132.5	134	147	148.5	20.5	80
	2. Barrow	161	166	168	164	179.5	185	24	
	3. Barrow	197	205	211	216	245	232.5	35.5	
3	1. Sow	154	166	169.5	161	183	199	45	135
	2. Barrow	147	153	155.5	154	170.5	183	36	
	3. Barrow	178	188	190	184	210	232	54	
4	1. Sow	146	155	168	175.5	189	205	59	152
	2. Barrow	122	131	141.5	144	150.5	167	45	
	3. Barrow	200	208	222	226	236	248	48	

Total consumption of food in 33 days:

Pen No. 1 consumed 668.5 lbs. ground peas.

Pen No. 2 consumed 2598 lbs. sweet potatoes.

Pen No. 3 consumed 663.5 lbs. field peas.

Pen No. 4 consumed 915 lbs. corn.

Pen No. 1 consumed 22.2 20.2 lbs. of ground peas per day, or 6.7 lbs. per pig. The ground peas were weighed in the hull.

No. 2 consumed 78.7 lbs. sweet potatoes per day—26.2 lbs. per pig.

No. 3 consumed 20.1 lbs. field peas per day—6.7 lbs. per pig.

No. 4 consumed 27.7 lbs. of corn per day—9.2 lbs. per pig per day.

Pen No.	Daily Gain per Pen 1st Period	Mean Temperature 1st Period	Daily Gain per Pen 2nd Period	Mean Temperature 2nd Period	Daily Gain per Pen 3rd Period	Mean Temperature 3rd Period	Daily Gain per Pen 4th Period	Mean Temperature 4th Period	Daily Gain per Pen 5th Period	Mean Temperature 5th Period
	lbs.	Deg.	lbs.	Deg.	lbs.	Deg.	lbs.	Deg.	lbs.	Deg.
1	7.33	32⅔	2.88	37½	1.14	34⅔	6.21	43½	4.06	46
2	2.58	32⅔	1.25	37½	.35	34⅔	8.25	43½	.56	46
3	4.66	32⅔	1.00	37½	*2.28	34⅔	9.21	43½	4.31	46
4	4.33	32⅔	4.68	37½	2.00	34⅔	4.28	43½	5.56	46

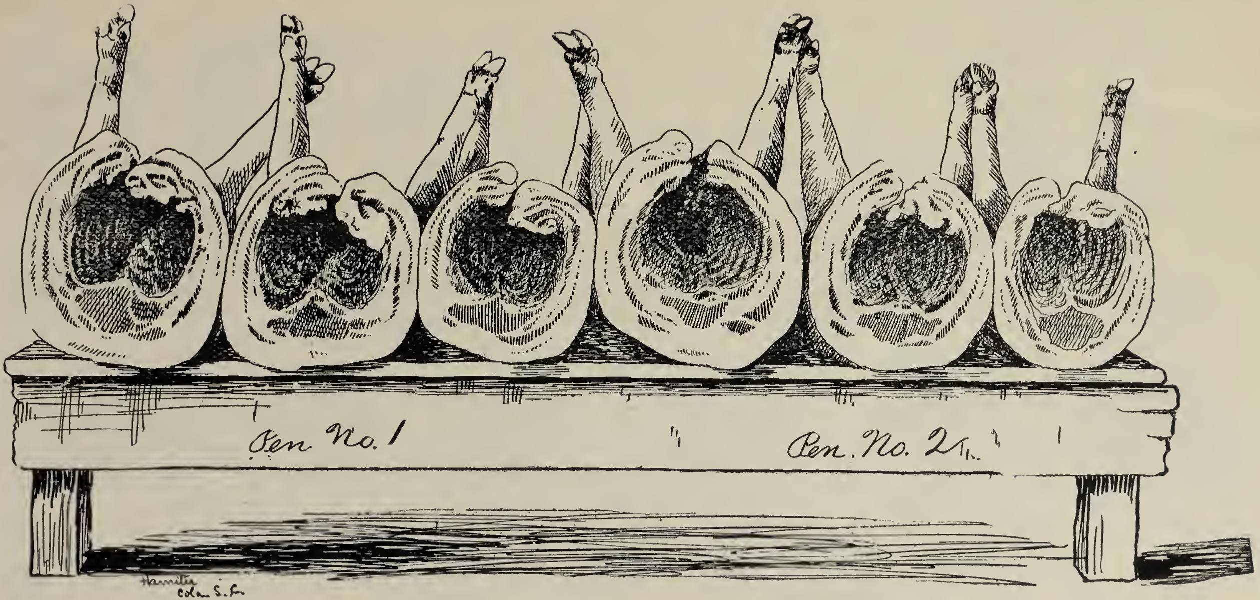
*Loss.

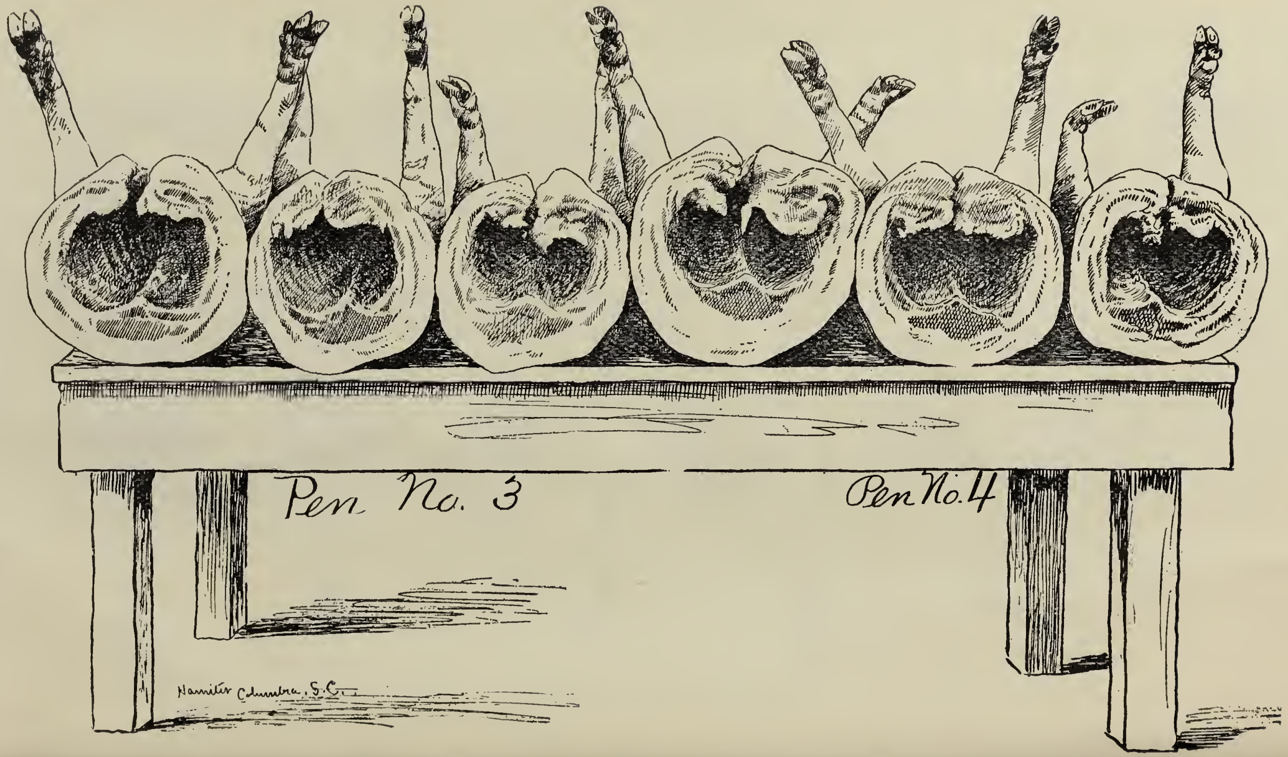
Average daily gain per pen for 5 periods:

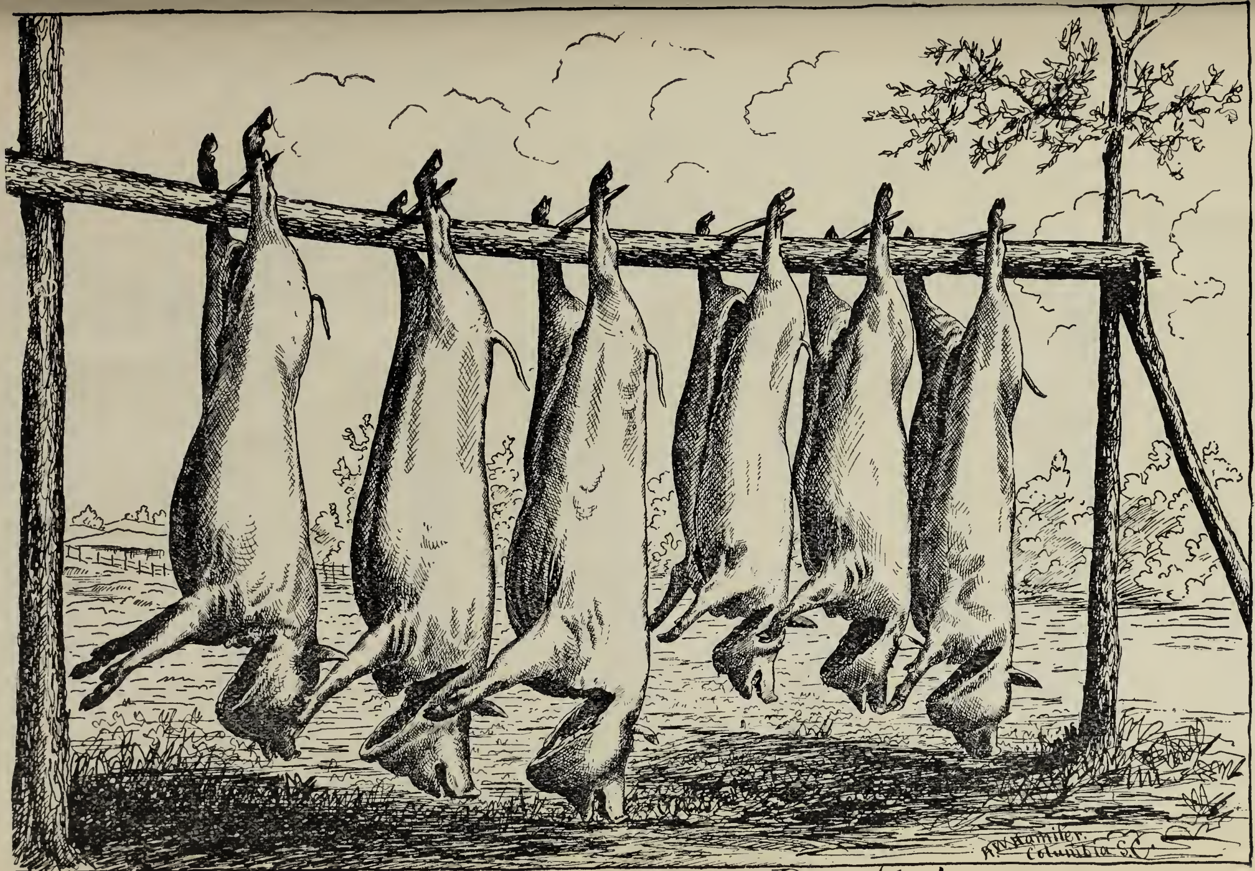
No. 1, 4.32 lbs.; No. 2, 2.59 lbs.; No. 3, 3.38 lbs.; No. 4, 4.17 lbs.

Average total gain per hog in ℔s. in each pen:

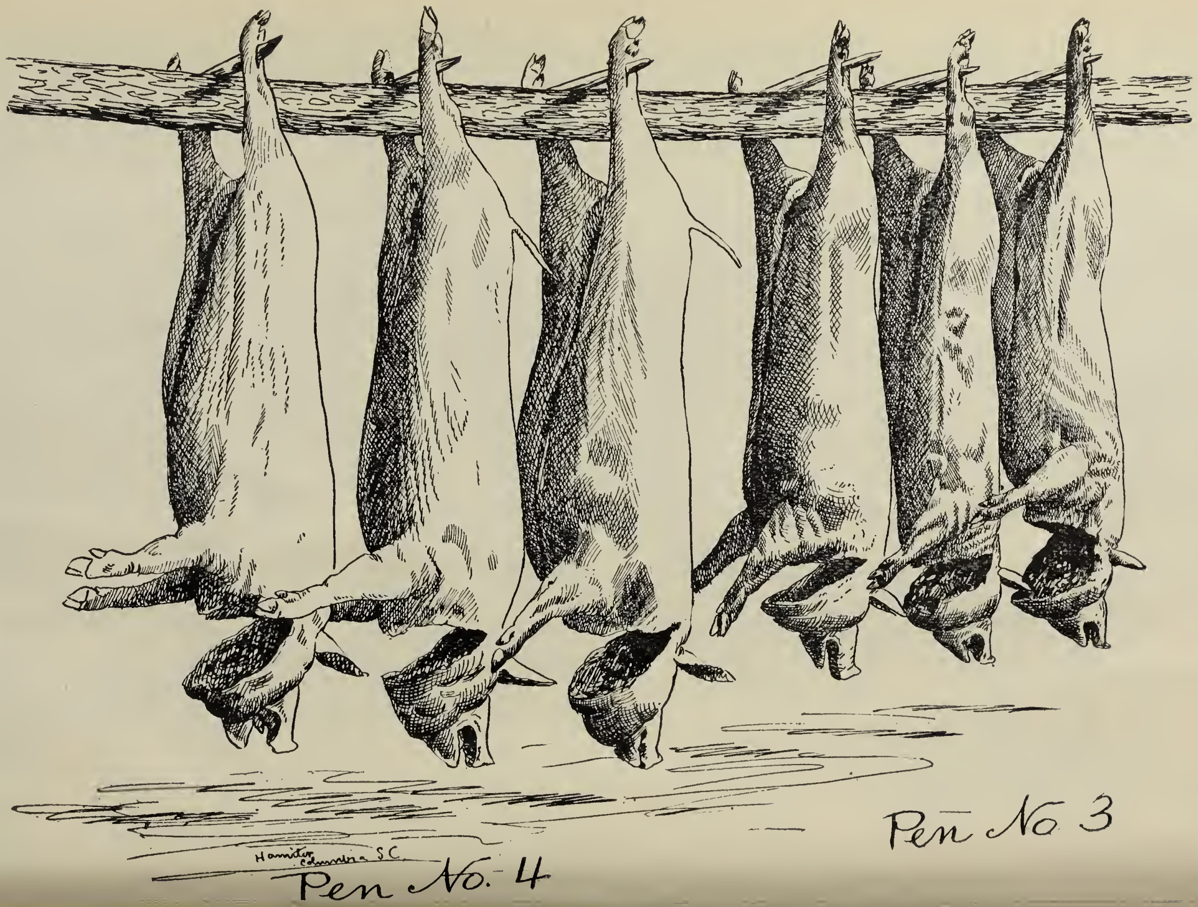
No. 1, 50.3; No. 2, 26.6; No. 3, 45; No. 4, 50.6.


Pen No. 1
Pen. No. 2


Pen No. 3
Pen No. 4
Hamilton Columbia, S.C.


R.W. Hamiter.
Columbia S.C.

Pen No. 2 Pen No. 1


Pen No 3
Hamilton Columbia S.C.
Pen No. 4

SOME DEDUCTIONS FROM RESULTS.

On land of the same character corn yielded 15 bushels per acre.

Spanish ground peas 90 bushels per acre.

Cow peas 10 bushels per acre.

Sweet potatoes 200 bushels per acre.

The cost of production of these crops, assuming that they are to be harvested by hogs will, with the exception of the cow peas, be practically the same.

It required 6.02 lbs. corn to produce 1 lb. pork.

It required 4.43 lbs. ground peas to produce 1lb. pork.

It required 32.47 pounds sweet potatoes to produce 1 lb. pork.

It required 4.91 lbs. cow peas to produce 1 lb. pork.

One acre of ground peas will produce 487.5 lbs. pork.

One acre of corn will produce 139.5 lbs. pork.

One acre of sweet potatoes will produce 369.5 lbs. pork.

One acre of cow peas will produce 122.5 lbs. pork.

At the foregoing rates of yield and pork production, and estimating pork at 5c. per pound:

Corn is worth per acre, $6.97.

Ground peas are worth per acre, $24.37.

Sweet potatoes are worth per acre, $18.47.

Cow peas are worth per acre, $6.12.

A record of the mean temperature for each period was kept. This ranged from 32 1-2 degrees to 46 degrees. No appreciable variation in the gain of fat is traceable to this cause.

The hogs used in this experiment were too far advanced in age, growth and fatness for the best results. "Pig feeding" should commence in pighood.

SHRINKAGE OF HAMS IN CURING.

Pen No. 1, fed on ground peas, shrinkage 22 per cent.

Pen No. 2, fed on sweet potatoes, shrinkage 27 per cent.

Pen No. 3, fed on cow peas, shrinkage 27 per cent.

Pen No. 4, fed on corn, shrinkage 23 per cent.

The hams from hogs fed upon ground peas exclusively, treated in every particular like the others, were somewhat tainted, while those from hogs from the other pens were well cured and sweet. The lean in these was coarse and stringy.

The lard from those fed exclusively upon ground peas showed the lowest melting point.

Samples of the ground peas used in this experiment were submitted to Prof. M. B. Hardin, chief chemist, for analysis. His report appended, not only shows the ground pea to be a valuable food for stock, even when separated from the vine, but presents an exceedingly interesting comparison between the two principal varieties, viz. "Virginia" and "Spanish," as to the relation between the proportion of hull and kernel.

ANALYSIS OF GROUND PEAS.

Col. M. B. Hardin, Chief Chemist.

Dear Sir: I beg leave to submit the following report of work done on the samples of ground peas received from the Agricultural Department October 22nd, 1898:

No. 214, Virginia Ground Peas.

Weight of one quart of nuts, as received, 252 gms—8.888 ozs.
Weight of one quart of nuts, air-dried, 176.1 gms—6.211 ozs.
Weight of one quart of nuts, water-free, 165.86 gms—5.850 ozs
*Weight of kernels (including husks) from above air-dried, 78.7 gms—2.776 ozs.
Weight of hulls from above air-dried, 97.4 gms—3.436 ozs.
*Weight of kernels (including husks) from above, water-free, 75.39 gms—2.659 ozs.
Weight of hulls from above, water-free, 90.49 gms—3.191 ozs.

*From this data the percentage of kernels (including husks) and hulls in the whole nut would be as follows:

	In the air-dry nut.	In the water-free nut.
Kernels	44.69 per cent.	45.45 per cent.
Hulls	55.31 per cent.	54.55 per cent.
	100.00	100.00

	In the Air-Dry Substance						In the Water-free Substance				
	Moisture	Crude Ash	Crude Protein	Crude Fat	Crude Fiber	N. Free Extract	Crude Ash	Crude Protein	Crude Fat	Crude Fiber	N. Free Extract
Kernels..........	4.20	2.14	25.88	48.36	2 54	16 88	2.23	27.01	50 48	2.65	17.63
Hulls............	7.12	1.94	4.25	0.70	71.47	14 52	2.09	4.58	0.75	76.95	15.63
Whole Nut (Calc)	5.81	2.03	13.92	21.99	40.67	15.58	2.15	14.78	23.35	43.18	16.54

No. 215, Spanish Ground Peas.

Weight of 1 quart of nuts as received, 331.1 gms—11.679 ozs.

Weight of 1 quart of nuts air-dried, 242.0 gms—8.536 ozs.

Weight of 1 quart of nuts water-free, 229.43 gms—8.093 ozs.

*Weight of kernels (including husks) from above, air-dried, 193.1 gms—6.811 ozs.

Weight of hulls from above, air-dried, 48.9 gms—1.725 ozs.

*Weight of kernels (including husks) from above, water-free, 184.20 gms—6.497 ozs.

Weight of hulls from above, water-free, 45.23 gms—1.595 ozs.

*From this data the percentage of kernels (including husks) and hulls in the whole nut would be as follows:

	In the air-dry nut.	In the water-free nut.
Kernels	79.79 per cent.	80.29 per cent.
Hulls	20.21 per cent.	19.71 per cent.
	100.00	100.00

	In the Air-Dry Substance						In the Water-free Substance				
	Moisture	Crude Ash	Crude Protein	Crude Fat	Crude Fiber	N. Free Extract	Crude Ash	Crude Protein	Crude Fat	Crude Fiber	N. Free Extract
Kernels..........	4.61	2.11	27.69	49.28	2.28	14.03	2.21	29.03	51.66	2.39	14.71
Hulls............	7.50	2.38	4.81	0.92	66.47	17.92	2.57	5.20	0.99	71.86	19.38
Whole Nut (Calc)	5.19	2.16	23.07	39.51	15.25	14.82	2.28	24.33	41.67	16 08	15.64

Respectfully submitted,

F. S. SHIVER.

Approved and respectfully forwarded to Col. Newman.

M. B. HARDIN, Chief Chemist.

The crops fed in this experiment were gathered and then fed to the hogs, thus unnecessarily increasing the cost of the materials used.

CHEAP HOG CROPS AND HOW TO USE THEM.

The following crops, all adapted to the South, if properly handled, will supply pasturage throughout the year for hogs:

Rye for winter and spring pasturage; rye and wheat for June pasturage; ripe ground peas, chufas and artichokes for fall, winter and early spring; in conjunction with green rye, early black-eyed, whippoorwill or bunch black peas to follow the wheat harvest, sweet potatoes and early varieties of corn in July and August, together with early crop of Spanish ground peas and field peas and early amber sorghum, followed by patches of larger varieties of sorghum and the regular fall crops of corn, potatoes, field peas and ground peas, leaving the chufas and artichokes to be used during the winter and early spring. There should be a permanent pasture of Bermuda, together with vetch or some perennial grass adapted to the soil and climate, to be used as a run when the ground is too wet to be rooted by the hogs in the special crops. Bermuda furnishes pasturage for hogs equal to and more permanent than clover.

By planting the various crops named adjacent to the Bermuda pasture the hogs may be turned at will upon one or more of them until the crop is gathered.

This can be done by the use of movable fencing, using some form of light cable wire fencing. This may be made in 100 feet or 200 feet sections, as most convenient, by fastening wire to 2x3-inch posts of some hard and durable wood. These posts should extend 18 inches below the wire if to be used on firm soil or 24 inches on porous soils. A solid piece of dog wood, gum or ash shod at point and cap with iron and having a pin 1 1-2 inches thick passed through six inches from the top, for convenience in handling, is used to open the holes for the posts attached to the wire to avoid splitting these in driving them into the soil. These sections of cable wire fence when not in use may be rolled and carried on the shoulder of a man or in a wheel-barrow.

This solves the problem of movable fencing so difficult of solution in the past, and will solve also the question of cheap pork in the South wherever intelligently used in connection with our special hog crops.

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BULLETIN 53. APRIL, 1900.

South Carolina Agricultural Experiment Station.

Clemson Agricultural College.

(S. C. A. & M. COLLEGE.)

ANALYSIS OF COMMERCIAL FERTILIZERS.

Address all communications to

S. C. EXPERIMENT STATION, Clemson College, S. C.
Freight and Express Office: Calhoun, S. C.
Telegraph Office: Clemson College.

The Bulletins of this Station are sent FREE to all citizens of the State requesting them.

Bulletins are not issued monthly, but at irregular intervals, not less than four a year.

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*Engaged in Fertilizer Analyses.

Analyses of Commercial Fertilizers.

SEASON OF 1899-1900.

This bulletin contains the analyses of 176 samples of fertilizers collected this season. Part II of this report, giving the analyses of all other brands of fertilizers sampled this season, will be published as soon as the analytical work is completed. These samples are taken by the official inspectors from goods found in the open market throughout the State.

Our State law provides: "That if any fertilizer or commercial manure offered for sale in this State shall upon analysis prove deficient in any of its ingredients, and if by reason of such deficiency the commercial value thereof shall fall three per cent. below the guaranteed commercial value of said fertilizer, such fertilizer shall be deemed fraudulent, and any note or obligation given in payment therefor shall be collectible at law only for the amount of the actual commercial value as ascertained by the analysis, and the person or corporation selling the same shall be liable to the purchaser for such damages as may be sustained by reason of such deficiency."

In the tables, under the headings *found and guaranteed* one can compare at a glance the results of the analyses made in our laboratory and the relative commercial values calculated from these results, with the guarantees made by the manufacturers and the commercial values calculated from these guarantees. The figures in the tables represent pounds per hundred.

The commercial valuations of raw materials for this season are as follows:

	Per Unit.	Per Pound.
Phosphoric Acid (available)...............	$ .65	$ .03 1-4

Ammonia, in Sulph. Ammonia	2.60	.13
“ Equivalent to Nitrogen, in Nitrate Soda	2.35	.11 3-4
“ Equivalent to Nitrogen, in Dried Blood	2.50	.12 1-2
“ Equivalent to Nitrogen, in Cotton Seed Meal	2.25	.11 1-4
Potash in Muriate Potash	.90	.04 1-2
“ in Kainit	.90	.04 1-2
“ in Sulph. Potash	1.00	.05

In mixed fertilizers the ingredients are valued as follows:

Phosphoric Acid (available)	.65	.03 1-4
Ammonia	2.40	.12
Potash, soluble in water	.90	.04 1-2

These are average cash retail prices of unmixed ingredients in raw materials, f. o. b. Charleston, S. C., October, 1899. They are based on actual quotations given by leading manufacturers and dealers on the materials used in manufacturing fertilizers. These valuations are required by law to be made October 1st of each year, and are used in calculating the commercial value of all fertilizers during the following season. Since all fertilizer material is subject to the fluctuations of the market, it is impossible to fix actual values for an entire season, hence these values should be regarded only as relative, although they may be considered as fairly approximate.

THE COMPOSITION OF COMMERCIAL FERTILIZERS

The three ingredients which give to fertilizers their commercial value, are phosphoric acid, nitrogen and potash.

Phosphoric Acid.—This term, when used in connection with fertilizers, means a compound of phosphorus (P) and oxygen (O), known to chemists as anhydrous phosphoric acid or phosphoric anhydride (P_2O_5). This substance exists in fertilizers chiefly in combination with lime, forming phosphates of lime, though it occurs to some extent combined with oxide of iron and alumina, forming phosphates of these substances. It is occasionally found in small quantity in acid phosphates, especially when recently prepared, along with water as hydrated or true phosphoric acid, and in this condition is said to be "free."

Soluble Phosphoric Acid is the phosphoric acid which, whether free or combined, is readily soluble in water. In the manufacture of acid phosphates it is produced by treating insoluble phosphates, such as bone, bone-ash, bone-black, or South Carolina rock with sulphuric acid. While the water-soluble phosphoric acid has exactly the same composition, no matter from what materials it is derived, yet an acid phosphate made from raw bone contains nitrogen in addition to phosphoric acid, and in this respect differs from an acid phosphate made from phosphate rock. The phosphoric acid in the two cases is identical in character and value as a fertilizer, but it is manifestly incorrrect to designate as "dissolved bone" an acid phosphate made from phosphate rock. When an acid phosphate is put in the soil, the soluble phosphoric acid changes into "reverted" and insoluble phosphoric acid and is not liable to loss from leaching.

Reverted or Precipitated Phosphoric Acid is the phosphoric acid of phosphates which were once soluble in water, but which from chemical changes, have "gone back" into a condition insoluble in water. The phosphoric acid of these phosphates is soluble in a solution of citrate of ammonia of a certain strength and temperature, and is, together with the phosphoric acid of other phosphates which are soluble in this solution, frequently spoken of as *citrate soluble* phosphoric acid.

Available Phosphoric Acid—As the reverted phosphoric acid has been proved by experiment to be about equal in value as plant food to the water-soluble phosphoric acid, it is customary to designate the soluble and reverted together as available phosphoric acid. The acid phosphates made in this State contain from 10 to 15 per cent., most of them from 13 to 14.5 per cent. of available phosphoric acid. The acid phosphates sampled by our inspectors during the last six years, from goods made both in and out of the State, have shown an average of 13.30 per cent. of available phosphoric acid.

Insoluble Phosphoric Acid is the phosphoric acid of phosphates which are not soluble either in water or in solution of citrate of ammonia. The phosphoric acid of phosphate rocks is almost entirely in the insoluble condition; that of bones is largely in the same state, but on account of the changes which go on in the decay of bones, the phosphoric acid in them becomes available in the soil much sooner than that in ground phosphate rock. The law of this State does not include insoluble phosphoric acid among the essential ingredients of fertilizers.

Nitrogen occurs in fertilizers in three forms of combination, organic nitrogen, ammonia and nitrates.

Organic Nitrogen is the nitrogen of animal and vegetable matters. The nitrogen of blood, flesh and cotton seed is easily converted in the soil into ammonia and nitrates and is therefore active as a fertilizer. The nitrogen of leather and horn is but slowly and with difficulty converted into available forms, and the use of these substances in the manufacture of commercial fertilizers is made a misdemeanor by the laws of this State. Dried blood of high grade contains about 13 per cent. of nitrogen, equivalent to about 16 per cent. of ammonia. Tankage is very variable, containing from 6 to 12 per cent. of nitrogen and more or less phosphoric acid according to the amount of bone present. Fish-scrap is also somewhat variable, but generally contains about 7 per cent. of nitrogen and nearly the same percentage of total phosphoric acid. Cotton-seed meal contains from 6.5 to 7.5 per cent. of nitrogen, equivalent to from 7.9 to 9 per cent. of ammonia. The average composition of 188 samples of the meal collected in this State during the last six years is as follows: Nitrogen 6.97 per cent., equivalent to ammonia 8.46 per cent; available phosphoric acid, 2.52 per cent.; water-soluble potash 1.58 per cent. The meal contains in addition about 0.2 per cent. of phosphoric acid and about 0.3 per cent. of potash insoluble, according to our present methods of analysis. In order to calculate the percentage of ammonia in any case from a given percentage of nitrogen, multiply the percentage of nitrogen by 1.214.

Ammonia occurs in commercial fertilizers as sulphate of ammonia, and furnishes nitrogen in one of its most active forms of combination. The commercial article of high grade contains about 20.6 per cent. of nitrogen, equivalent to 25 per cent. of ammonia.

Nitrates.—The nitrate found in commercial fertilizers is nitrate of soda. It contains nitrogen in probably its most active state. It carries from about 15 to 16 per cent. of nitrogen, equivalent to from 18 to 19.5 per cent. of ammonia. When nitrogenous organic substances decay in the soil, their nitrogen becomes converted into ammonia and nitrates, the nitrates being the final product. Ammonia may furnish plants directly with nitrogen, but in most cases it is probably first changed into nitrates. It is generally believed that, with the exception of leguminous crops and certain low forms of plant life, all plants absorb their nitrogen from nitrates. While organic nitrogen and ammonia are not liable to be washed out from the soil, nitrates are, in the absence of vegetation, readily removed by leaching. This is an important fact to remember in connection with the use of nitrate of soda as a fertilizer.

Free, or Uncombined, Nitrogen exists in the air, of which it constitutes about four-fifths by volume. It is well known that leguminous plants, peas, beans, clover, &c., with the aid of certain micro-organisms, present in most soils, are able to gather nitrogen from the air. By a proper use of this knowledge, the necessity of buying nitrogen, which is the most expensive ingredient of fertilizers, is to a great extent avoided.

Potash.—When this term is used with reference to fertilizers it signifies a compound of potassium (K) and oxygen (O), known as potassium oxide (K_2O). While this substance may be regarded as existing in the sulphate, carbonate, and silicate of potash, it cannot be considered to exist in the so-called "muriate," which is really a compound of potassium and chlorine, properly called potassium chloride. As, however, the potassium in the muriate is chemically equivalent to a certain amount of potash, it is customary, for purposes of comparison, to reckon and report the potassium in it and in all other potash salts as potash (K_2O). Thus the high grade sulphate of potash of commerce is said to contain about 50 per cent., the muriate about 50 per cent., and kainit about 12.5 per cent. of potash. In all these salts the potash is soluble in water. Cotton-hull ashes contain potash chiefly in the form of carbonate. The samples of these ashes which have been examined in this laboratory contain about 18 per cent. of soluble potash and about 5 per cent. of potash insoluble in water. The other compounds of potassium on the market are sylvinite, chiefly a chloride, containing the equivalent of about 18 per cent. of potash; the sulphate of potash-magnesia, containing from 24 to 27 per cent.; the carbonate of potash-magnesia, containing about 18 per cent., and the silicate,* containing, according to the analysis of the only sample yet received at this laboratory, about 20 per cent. of potash. The percentages given refer to potash soluble in water.

While the potash in kainit is probably nearly all in the form of sulphate, it is associated with a large quantity of the chlorides of sodium and magnesium which make the effect of kainit, in some respects, like that of the muriate and sylvinite, which contain the potassum itself as chloride.

Neither muriate of potash, sylvinite, nor kainit should be used when chlorides are objectionable, as for instance on tobacco, the burning qualities of which are injured by fertilizers containing chlorides. Although the potash salts are soluble in water, the potash in them is not readily washed out from the soil. The acids of the salts are leached out in combination generally with lime, but the potash is fixed by uniting with other constituents of the soil.

THE COMMERCIAL VALUATION OF FERTILIZERS.

At this Station, the valuation of a fertilizer consists simply in calculating the cost of the raw materials of good quality which will furnish the amount of available phosphoric acid, nitrogen, and soluble potash contained in the fertilizer. The nitrogen is estimated as ammonia. As the raw materials depend for their value solely upon the amount of the essential ingredients they contain, the valuation of a fertilizer is based upon the percentages of these ingredients as found by analysis and their average money values as determined for the season. See the following tables of analysis, and the table of values per pound and per unit, pages 3 and 4.

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*This sample was a mixture of potassium silicate and peat.

An example will make this plain. Suppose a fertilizer shows upon analysis the following composition, regard being paid only to the available phosphoric acid, ammonia and water-soluble potash.

ANALYSIS.

Available Phosphoric Acid	9.00 per cent.
Ammonia	2.42 per cent.
Potash Soluble in Water	2.16 per cent.

Multiply the per cent. (pounds per hundred) of each ingredient by 20. This will give the number of pounds of each ingredient in a ton of 2,000 pounds. Multiply the number of pounds thus found in the case of each ingredient by the value of that ingredient per pound, and add the products obtained. The result will be the valuation of a ton of the fertilizer. Thus:

	Pr Ct. (lbs. per 100)	Pounds per ton.	Value per lb.	Value per ton.
Available Phosphoric Acid	9.00	180	$0.03 1-4	$5.85
Ammonia	2.42	48.4	.12	5.81
Potash Soluble in Water	2.16	43.2	.04 1-2	1.94

Relative commercial valuation per ton of 2,000 lbs. . . $13.60

This is the average cost of the raw materials f. o. b. Charleston, S. C., October 1st, 1899.

Or, the calculation may be made by "units."

A unit is one per cent. of 2,000 pounds, that is, 20 pounds per ton. If, as in the foregoing table, one pound of available phosphoric acid is worth $0.03 1-4, 20 pounds, or one "unit" is worth $0.65, and so for the other ingredients. It is obvious that the number of pounds per hundred is the same in any case as the number of "units" per ton, both represent the same percentage. Therefore, multiply the per cent., or number of units, of each ingredient by the unit value of that ingredient and add the products. The sum will be the estimated value per ton. Thus:

	Per cent. Units	Value Per Unit	Value Per Ton
Available Phosphoric Acid	9.00	$0.65 —	$5.85
Ammonia	2.42	2.40 —	5.81
Potash Soluble in Water	2.16	.90 —	1.94

Relative commercial valuation per ton of 2,000 lbs . . $13.60

This is the average cost of the raw materials f. o. b. Charleston, S. C., October 1st, 1899.

As the market prices of raw materials are liable to fluctuation, the valuations based upon a constant price for the season are of course only approximate, but they show pretty well the relative commercial values of different fertilizers upon the assumption that in all cases materials of good quality have been used in the manufacture. The difference between the valuation and the selling price at seaboard represents the charges for manufacture and profits. The commercial value of a fertilizer does not bear a strict relation to its agricultural value in every case, for while the former depends largely upon trade conditions, the latter depends upon the fertilizing effects produced, and these can be determined only by experience. In purchasing fertilizers, farmers should be governed not only by the selling price, but also, and especially, by the composition as guaranteed or shown by analysis. They should buy only from well-known and honorable manufacturers, and should select fertilizers containing such proportions of the essential ingredients as experience has shown to be best adapted to their soils and crops.

M. B. HARDIN.

REGULATIONS GOVERNING THE SALES OF COMMERCIAL FERTILIZERS IN SOUTH CAROLINA.

SEASON 1899-1900.

1. All persons or companies engaged in the manufacture or sale of commercial manures are required to pay to the State Treasurer twenty-five cents per ton on every ton of such fertilizer sold or offered for sale in South Carolina.

2. Every bag, barrel or other package of such fertilizer shall have thereon a plainly printed label or stamp which shall truly set forth the name, location, and trade mark of the manufacturer, also the chemical composition of the contents of such package, and the *real percentage* of any of the following ingredients asserted to be present, to wit: Soluble and precipitated phosphoric acid, soluble potassa, ammonia or its equivalent in nitrogen, together with the date of its analysis; and every package must also bear the inspection tax tag issued by the Board of Trustees of C. A. C.; and must be branded "High Grade," "Low Grade," or "Standard," as required by Act of 1898.

3. All chemical compounds sold or offered for sale as fertilizers, including burnt marl, kainit, ground bone, fish scrap, tankage, cotton seed meal, etc., are subject to the payment of the inspection tax.

4. All applications for tax tags must be made to State Treasurer, Columbia, S. C., and all checks, money orders, etc., in payment therefor, must be made payable to his order.

5. Manufacturers and dealers are required to send the guaranteed analysis of their goods, to be filed in this office, before making application for tax tags. Blanks for this purpose will be furnished on application to this office. Manufacturers are also required to send to this office a true sample of each and every brand of fertilizer or commercial manure of not less than one pound intended to be offered for sale within the State during the season.

6. Samples of fertilizers for analysis will be drawn by agents, appointed by the Board of Fertilizer Control, from any lots of fertilizers found on the market in any part of the State.

7. Our fiscal year begins Nov. 1st, and all fertilizers sold after that date must bear the tax tag of the current year.

8. Manufacturers or dealers having tax tags left over from last season may return them to this office and exchange them for tags of the present season.

9. All persons, companies or corporations engaged in the manufacture or sale of fertilizers or commercial manures shall cancel all tags or stamps used as evidence that said inspection tax has been paid, by stamping such tags or stamps with the name of the person or persons, company or corporation selling, shipping or manufacturing; also, the date of shipment or delivery. No railroad or common carrier shall receive for shipment or delivery from any person or persons, company or corporation, any fertilizers or commercial manures with the tags or stamps bearing date of cancellation thirty or more days prior to delivery for shipment.

10. All communications for this office should be addressed to the undersigned, Clemson College, S. C.

J. P. SMITH, Secretary.

By order of the Board of Control.

FARMERS' SAMPLES.

Attention is called to the following Act passed at the last session of the Legislature and now in force:

AN ACT

To Provide a Means Whereby Any Purchaser, in This State, of Any Commercial Fertilizers or Manures, May Have the Same Analyzed by Clemson Agricultural and Mechanical College, Free of Costs, and to Provide a Penalty for Delivering Fertilizers or Manures Short in Ingredients Appearing on Sack or Vessel Holding Same.

SECTION 1.

Be it enacted by the General Assembly of the State of South Carolina: That from and after the passage of this Act, any citizen of this State who shall purchase any Commercial Fertilizers or Manures, shall have the right to have the same analyzed by Clemson Agricultural and Mechanical College by taking a sample of same within ten days of receipt thereof from at least ten per cent. of such fertilizers in the presence of at least two disinterested witnesses. One to be chosen by the purchaser and one by the seller, who shall certify that such sample was taken from such fertilizers or manures, which certificate, with the sample, shall be sealed by a third disinterested party in the presence of said witnesses, and directed to Clemson Agricultural and Mechanical College.

SECTION 2.

The said college shall have the said sample analyzed free of cost, and within three months after receiving the sample, supply the purchasers of such fertilizers or manures with a certificate giving the per cent. of the different fertilizing ingredients of same, signed by the Chemist of Clemson Agricultural and Mechanical College, which certificates shall be admissible as evidence in all suits relative to such fertilizers or manures whether the same be instituted by the vendor or purchaser of same.

SECTION 3.

That any vendor of Commercial Fertilizers or Manures whose goods or wares fall short to the extent of ten per cent. in any fertilizing ingredient guaranteed by the analysis appearing on the sack or vessel holding same, when delivered to the purchaser, shall forfeit one-half the sale price thereof, to be recovered by suit or set up as a counter-claim to an action for the purchase price of such fertilizers or manures.

SECTION 4.

Be it further enacted: That if any seller or vendor of fertilizers or commercial manures shall refuse, decline or neglect to choose a witness, as provided in SECTION 1, after having been notified or requested by the purchaser so to do, then he or they shall have forfeited their rights so to do, and the purchaser shall select two witnesses, who shall select the third witness, who shall proceed to take samples as herein before provided. All samples of fertilizers drawn under the provision of this Act shall be subject to such other rules as may be prescribed by the Board of Trustees of Clemson College not inconsistent with the provisions of this Act.

SECTION 5.

All Acts and parts of Acts inconsistent with this Act be, and the same are hereby repealed.

Approved the 19th day of February A. D. 1900.

FERTILIZER ANALYSIS FOR FARMERS.

Directions for Drawing Farmers' Samples.

Take portions of the sample from at least one sack in every ten of the lot sampled. If there should be less than ten sacks in the lot, portions should be taken from several sacks. Mix the portions thoroughly and from the lot select about one quart. Place this in a clean wide-mouth bottle or jar and seal tightly.

Place the name and address of the sender, the number of the sample (if more than one sample is sent), the date of drawing, where drawn, and the names of the ingredients claimed (Phosphoric Acid, Ammonia, and Potash, either or all of them), on each bottle.

The samples must be drawn in the presence of two witnesses, one representing the purchaser and one the seller, as required by law.

Pack securely in a box and forward by express prepaid to Fertilizer Department, C. A. C., Calhoun, S. C. Samples of fertilizers drawn in accordance with above directions will be analyzed and the results will be mailed to persons sending the samples as early as possible without interfering with the work on official samples.

No samples will be analyzed unless these rules are complied with.

No charge will be made for the analysis.

Instructions and blank certificates may be obtained by applying to the Fertilizer Department, Clemson College, S. C.

TABLE I. Ammoniated Fertilizers.

Sample No.	Brand of Fertilizer	Moisture	FOUND									GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid																
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
310	Acme Fert. for Tobacco	9.90	10.27	2.24	5.58	2.45	8.03	2.49	3.03	2.54	14 78	8.00	3.00	2.50	14.65	Jan. 19	Nichols	Acme Mfg. Co.	Wilmington, N.C.
125	Alkaline Guano	10.19	14.17	3.99	7.06	3.12	10 18	1.85	2.25	1.02	12.94	8.00	2.00	1.00	10.90	Jan. 15	Anderson	Va.-Carolina Chem. Co.	Charleston, S. C.
168	Arrow Brand Guano	15.57	11.00	.90	5.97	4.13	10.10	2.18	2.65	1.19	14.00	8.00	2.50	1.00	12.10	Jan. 27	Belton	F. S. Royster Guano Co.	Norfolk, Va.
207	Ashepoo Guano	11.39	9.93	1.00	6.84	2.09	8.93	2.26	2.74	1.29	13.54	8.00	2.50	1.00	12.10	Jan. 6	Barnwell	Ashepoo Fert. Co.	Charleston, S. C.
326	Baugh's H. G. Tob. Guano	13.88	11.01	1.66	5.16	4.19	9.35	2.88	3.50	3.41	17.55	8.00	3.00	3.00	15.10	Jan. 25	Marion	Baugh & Sons Co.	Norfolk, Va.
208	Baldwin's Amm. Diss. Bone.	17.78	11.25	1.89	7.42	1.94	9.36	1.69	2.05	2.40	13.16	9.00	2.00	2.00	12.45	Jan. 8	Edgefield	Va.-Carolina Chem. Co.	Charleston, S. C.
215	Blood and Bone, No. 8	7.20	11.58	4.05	.27	7.26	7.53	6.69	8.12	....	24.38	9.00	8.00	....	25.05	Jan. 16	Martin's Point.	Armour Packing Co.	Kansas City, Mo.
175	Blood Guano	12.06	12.26	2.25	6.65	3.36	10.01	1.86	2.26	1.69	13 45	8.50	2.00	2.00	12.13	Jan. 30	Pelzer	Va.-Car. Chem. Co	Charleston, S. C.
111	Bone Mixture	10.31	11.08	1.36	6.84	2.88	9.72	1.65	2.01	1.17	12.20	8.00	2.00	1.00	10.90	Jan. 6	Anderson	Richmond Guano Co.	Richmond, Va.
324	Capital Tobacco Fertilizer	10.90	11.31	2.07	7.45	1.79	9.24	2.99	3.63	3.01	17.43	8.00	4.00	3.00	17.50	Jan. 25	Marion	Va.-Car. Chemical Co	"
189	Carolina Amm. Bone	10.90	12.20	2.34	5.82	4.04	9.86	2.08	2.53	1.22	13.58	8.00	2.50	1.00	12.10	Feb. 9	Greenwood	" "	"
21	Chicora H. G. Fertilizer	11.42	11.51	2.33	7.37	1.81	9.18	2.06	2.50	1.27	13.11	8.00	2.50	1.00	12.10	Jan. 18	Chester	" "	"
305	Edisto Amm. Fertilizer	14.52	11.85	1.88	7.69	2.28	9.97	2.18	2.65	1.25	13.97	8.00	2.50	1.00	12.10	Jan. 17	Cheraw	" "	"
214	Early Trucker	8.87	9.46	1.03	4 83	3.60	8.43	4.13	5.02	5.22	22.23	7.00	5.00	5.00	21.05	Jan. 16	Martin's Point.	Lazaretto Guano Co.	Baltimore, Md.
203	Eutaw Guano	12.28	11.26	2.39	6.70	2.17	8.87	2.16	2.62	1.15	13.09	8.00	2.50	1.00	12.10	Jan. 4	St. Matthews.	Ashepoo Fert. Co.	Charleston, S. C.
53	Farmers' Bone Fertilizer	16.07	9.98	.36	6.20	3.42	9.62	1.98	2.40	2.26	14.05	8.50	2.00	2.00	12.13	Feb. 5	Chester	F. S. Royster Guano Co.	Norfolk, Va.
252	Farmers' Friend Fertilizer	15.35	9.80	.88	6.15	2.77	8.92	2.39	2.90	1.85	14.42	8.00	2.50	1.00	12.10	Feb. 12	Blackville	Read Phosphate Co.	Charleston, S. C.
136	Farmers' Bone Fertilizer	14.54	11.40	1.74	6.14	3.52	9.66	1.71	2.08	2.33	13.37	8.50	2.00	2.00	12.13	Jan. 18	Greers	F. S. Royster Guano Co	Norfolk, Va.
12	Ga. State Grange Fertilizer	10.25	13.69	4.40	6.19	3.10	9.29	1.67	2.03	2.00	12.71	9.00	2.00	2.00	12.45	Jan. 2	Clinton	Va.-Carolina Chem. Co.	Richmond, Va.
39	Gibb's H.G.Amm. Sol.Guano	14.57	12.72	3.59	6.51	2.62	9 13	2.36	2.87	1.38	14.06	8.00	2.50	1.00	12.10	Jan. 27	Chester	" "	"
126	Globe Amm. Fertilizer	10.43	12.05	2.37	6.41	3.27	9.68	2.08	2.53	1.04	13.30	8.00	2.50	1.00	12.10	Jan. 15	Anderson.	" "	"
329	Golden Tobacco Producer	10.25	10.54	1.02	7.57	1.95	9.52	2.50	3.04	3.11	16.28	8.00	3.00	3.00	15.10	Jan. 25	Marion	Ashepoo Phos. Co.	Charleston, S. C.
375	Golden L'f BrightTob.Guano	10.67	11.67	2.64	7.10	1.93	9.03	2.64	3.21	3.59	16.80	8.00	3.00	3.00	15.10	Feb. 8	Dillon	Va.-Carolina Chem. Co.	Richmond, Va.
156	G. W. G. Soluble Guano	11.13	9.11	.35	7.51	1.25	8.76	2.40	2.92	1.56	14.11	8.00	2.50	1 00	12.10	Jan. 24	Seneca	Seneca Fert. Co.	Seneca, S. C.
220	H. G. Truck Guano	7.75	8.58	1.24	5.35	1.99	7.34	6.73	8.17	5.61	29.43	7.00	8.00	5.00	28.25	Jan. 17	Young's Island.	Lazaretto Guano Co.	Baltimore, Md.
306	Imperial Amm. Fertilizer	11.58	12.51	2.05	7.64	2.82	10.46	2.24	2.72	1.48	14.66	8.00	2.50	1.00	12.10	Jan. 17	Cheraw	Va.-Carolina Chem. Co.	Richmond, Va.
232	Imper'l Blood and Bone Fert.	11.20	12.29	2.81	7.42	2.06	9.48	2.31	2.81	1.62	14.36	8.00	2.50	1.00	12.10	Jan. 25	Camden	" "	"

TABLE I. Ammoniated Fertilizers.—Continued.

Sample No.	Brand of Fertilizer	Moisture	Found									Guaranteed				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid																
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
309	Latimer Complete Fertilizer	9.53	12.61	4.38	5.35	2.88	8.23	2.07	2.51	2.20	13.35	8.00	2.50	2.00	13.00	Jan. 19	Nichols........	Acme Mfg. Co...........	Wilmington, N.C.
14	Navassa Amm. Sol. Guano..	14.47	13.05	3.52	7.52	2.01	9.53	1.74	2.11	2.35	13.37	8.50	2.00	2.00	12.13	Jan. 2	Clinton........	Navassa Guano Co......	Wilmington, N.C.
321	Navassa Universal Fertilizer	14.25	11.26	1.71	7.32	2.23	9.55	2.54	3.09	1.80	15.24	8.00	2.50	1.00	12.10	Jan. 25	Marion........	" "	"
154	Oconee H. G. Guano........	13.99	10.76	.31	8.92	1.53	10.45	2.65	3.22	2.62	16.88	10.00	3.00	2.00	15.50	Jan. 24	Seneca........	Seneca Fert. Co....	Seneca, S. C.
25	Old Hickory Guano.........	10.88	12.86	3.26	7.29	2.31	9.60	2.24	2.72	1.50	14.12	8.00	2.50	1.00	12.10	Jan. 18	Chester........	Va.-Carolina Chem. Co..	Richmond, Va.
322	Orinoco Tobacco Guano....	14.80	9.88	.95	6.33	2.60	8.93	2.06	2.50	3.46	14.92	8.00	2.50	3.00	13.90	Jan. 25	Marion........	F. S. Royster Guano Co.	Norfolk, Va.
4	Owl Brand Guano.........	13.65	11.26	2.03	6.98	2.25	9.23	2.02	2.45	2.26	13.91	8.50	2.00	2.00	12.13	Dec. 19	Cowpens......	Va.-Carolina Chem. Co..	Richmond, Va.
110	Premium Brand Fertilizer...	11.40	11.56	1.20	7.54	2.82	10.36	1.47	1.79	1.87	12.71	8.50	2.00	2.00	12.13	Jan. 6	Anderson......	Richmond Guano Co....	"
170	Pocomoke Superphosphate..	10.52	10.46	1.32	6.08	3.06	9.14	1.65	2.01	2.14	12.69	8.50	2.00	2.00	12.13	Jan. 29	Anderson......	The Pocomoke Guano Co	Norfolk, Va.
218	Read's Cabbage Special.....	9.55	9.42	.68	2.64	6.10	8.74	6.37	7.73	5.37	29.07	7.00	8.00	5.00	28.25	Jan. 17	Enterprise.....	Read Phos. Co...........	Charleston, S. C.
219	Read's Potato Special.......	8.85	10.24	1.57	5.07	3.60	8.67	3.90	4.73	5.98	22.37	7.00	5.00	5.00	21.05	Jan. 17	Young's Island.	"	"
349	Red Bull Guano............	8.90	12.47	3.30	5.64	3.53	9.17	2.82	3.43	2.13	16.11	8.00	3.00	2.00	14.20	Feb. 7	Darlington....	Va.-Carolina Chem. Co..	Richmond, Va.
166	Rex Brand Amm. Guano....	16.81	11.00	1.25	5.71	4.04	9.75	1.84	2.24	1.19	12.78	8.00	2.50	1.00	12.10	Jan. 27	Belton.........	Columbia Guano Co.....	Norfolk, Va.
239	Rose Hill Guano...........	12.91	11.41	1.93	6.79	2.69	9.48	2.17	2.63	1.38	13.71	8.00	2.50	1.00	12.10	Jan. 30	Sumter........	Ashepoo Fert. Co........	Charleston, S. C.
124	Royal Soluble Guano........	11.36	13.52	3.66	6.82	3.04	9.86	1.65	2.01	1.18	12.30	8.00	2.00	1.00	10.90	Jan. 15	Anderson......	Va.-Carolina Chem. Co..	Richmond, Va.
52	Royster's Arrow Br'nd Guano	15.46	9.19	.41	5.69	3.09	8.78	2.26	2.74	1.61	13.73	8.00	2.50	1.00	12.10	Feb. 5	Chester........	F. S. Royster Guano Co.	Norfolk, Va.
318	Sea Fowl Guano............	14.70	11.85	1.41	8.09	2.35	10.44	2.07	2.52	1.63	14.30	9.00	2.25	1.00	12.15	Jan. 25	Marion........	Bradley Fert. Co.........	Charleston, S. C.
155	Seneca H. G. Guano..	12.17	9.15	.32	7.68	1.15	8.83	2.28	2.77	1.34	13.59	8.00	2.50	1.00	12.10	Jan. 24	Seneca........	Seneca Fert. Co.........	Seneca, S. C.
223	Special 4-4-6-Guano..........	7.82	8.26	1.74	3.71	2.81	6.52	3.34	4.05	6.31	19.64	4.00	4.00	6.00	17.60	Jan. 19	John's Island..	The W. C. Macmurphy Co.	Charleston, S. C.
179	Standard Amm. Fertilizer...	12.00	13.18	2.87	6.38	3.93	10.31	2.11	2.56	1.21	13.93	8.00	2.50	1.00	12.10	Feb. 1	Starr..........	Va.-Carolina Chem. Co.	Richmond, Va.
320	Standard 8-2½-1-Cotton Fert.	10.04	11.69	1.41	7.19	3.09	10.28	1.98	2.40	1.28	13.59	8.00	2.50	1.00	12.10	Jan. 25	Marion........	The W. C. Macmurphy Co.	Charleston, S. C.
307	Stono Complete Fertilizer...	11.78	11.18	2.12	6.10	2.96	9.06	2.10	2.55	1.35	13.22	8.00	2.50	1.00	12.10	Jan. 17	Cheraw........	Va.-Carolina Chem. Co.	Richmond, Va.
173	Swift's Golden Harvest Guano	9.27	10.57	2.02	3.33	5.22	8.55	1.68	2.04	1.08	11.43	8.00	2.50	1.00	12.10	Jan. 29	Anderson......	Swift Fert. Works......	Atlanta, Ga.
57	Wando Blood Guano........	14.55	12 23	2.19	7.98	2.06	10.04	1.85	2.25	2.38	14.07	8.50	2.00	2.00	12.13	Feb. 6	Johnston......	Va.-Carolina Chem. Co.	Richmond, Va.
114	Wando Complete Fertilizer..	11.50	12.23	2.25	7.00	2.98	9.98	2.19	2.66	1.05	13.82	8.00	2.50	1.00	12.10	Jan. 8	Anderson......	" "	"
311	Wilcox & G. Manip. Guano..	13.64	10.53	71	7.72	2.10	9.82	2.30	2.79	2.22	15.08	8.00	2.75	2.00	13.60	Jan. 22	Bennettsville..	The W. C. Macmurphy Co.	Charleston, S. C.
243	Wulbern's Amm. Fertilizer..	13.10	11.41	2.62	5.60	3.19	8 79	2.07	2.51	1.44	13.03	8.00	2.50	1.00	12.10	Feb. 3	Manning......	Va.-Carolina Chem. Co.	Richmond, Va.

TABLE II. Acid Phosphates, Without Potash.

Sample No.	BRAND OF FERTILIZER	Moisture	FOUND									GUARANTEED				Date Sampled	SAMPLED AT	MANUFACTURER	MANUFACTURED AT
			PHOSPHORIC ACID					Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
			Total	Insoluble	Soluble	Reverted	Available												
206	Ashepoo XX Acid Phos	10.35	14.74	1.14	11.27	2.33	13.60	....	....	....	8.84	12.00	....	....	7.80	Jan. 6	Barnwell	Ashepoo Fert. Co	Charleston, S. C.
31	Ashepoo H. G. Acid Phos	10.41	15.61	.60	12.01	3.00	15.01	....	....	....	9.76	13.00	....	....	8.45	Jan. 19	Chester	" "	"
331	Atlantic Diss. Bone	13.54	14.74	1.29	11.08	2.37	13.45	....	....	....	8.74	13.00	....	....	8.45	Jan. 25	Marion	Va.-Caro. Chemical Co.	Richmond, Va.
3	Capital Diss. Bone	11.76	15.72	1.83	10.55	3.34	13.89	....	....	....	9.03	13.00	....	....	8.45	Dec. 19	Cowpens	Va.-Caro. Chemical Co.	"
113	Cotton Brand Diss. Bone	10.55	15.38	1.87	11.39	2.12	13.51	....	....	....	8.78	13 00	....	....	8.45	Jan. 6	Anderson	" "	"
16	Chicora Diss. Bone	13.75	14.44	.90	10.87	2.67	13.54	....	....	....	8.80	12.00	....	....	7.80	Jan. 16	Ridgeway	" "	"
23	Chicora Diss. Bone	14.61	14.64	.96	11.32	2.36	13.68	....	....	....	8.89	13.00	....	....	8.45	Jan. 18	Chester	" "	"
28	Columbia Diss. Bone	12.90	14.92	1.55	10.46	2.91	13.37	....	....	....	8.69	13.00	....	....	8.45	Jan. 19	Chester	" "	"
167	Cherokee Diss. Bone	12 78	14.81	1.74	9.07	4.00	13.07	....	....	....	8.50	12 00	....	....	7.80	Jan. 27	Belton	" "	"
27	Cotton Brand Diss. Bone	13.42	13 89	1.23	9.95	2.71	12.66	....	....	....	8.23	13.00	....	....	8.45	Jan. 18	Chester	" "	"
247	Coomassie Acid Phos	11.27	15.13	.61	10.13	4.39	14.52	....	....	....	9.44	12.00	....	....	7.80	Feb. 7	St. Stephens	Ashepoo Fert. Co	Charleston, S. C.
149	Cherokee Diss. Bone	12.96	15.74	3.55	9.55	2.64	12.19	....	....	....	7.92	13.00	....	....	8.45	Jan. 23	Easley	Va.-Caro. Chemical Co.	Richmond, Va.
327	Durham Diss. Bone	10.19	16.31	2.48	8.49	5.34	13.83	....	....	....	8 99	13.00	....	....	8.45	Jan. 25	Marion	" "	"
144	Edisto Acid Phos	9.56	15.63	1.56	11.01	3.06	14.07	....	....	....	9.15	13 00	....	....	8.45	Jan. 23	Liberty	" "	"
301	Edisto Diss. Bone	13.47	15.30	1.28	10.81	3.21	14.02	....	....	....	9.11	13.00	....	....	8.45	Jan. 15	Bennettsville	" "	"
108	Eureka Acid Phos.	11.03	15.10	1.42	11.21	2.47	13.68	....	....	....	8 89	13.00	....	....	8.45	Jan. 6	Anderson	" "	"
127	Eureka Diss. Bone	12.01	15.65	2.58	10.87	2.20	13.07	....	....	....	8.50	13.00	....	....	8.45	Jan. 15	Anderson	" "	"
42	Eutaw H. G. Acid Phos.	10.20	15.56	.67	11.04	3.85	14.89	....	....	....	9 68	13.00	....	....	8.45	Jan. 29	Chester	Ashepoo Fert. Co	Charleston, S. C.
313	Game Cock Diss. Bone	12.10	14.92	1.00	11.86	2.06	13.92	....	....	....	9.05	13 00	....	....	8.45	Jan. 22	Bennettsville	Va.-Caro. Chemical Co.	Richmond, Va.
209	Ga. State Grange Diss. Bone	11 67	15.49	1.98	10.85	2.66	13.51	....	....	....	8.78	13.00	....	....	8.45	Jan. 8	Edgefield	" "	"
182	Ga. State Grange Diss. Bone	12.47	14.55	1.18	8.06	5.31	13.37	....	....	....	8.69	12.00	....	....	7.80	Feb. 6	Lowndesville	" "	"
35	Imperial Diss. Bone	13.59	15.68	.97	11 48	3.23	14.71	....	....	....	9.56	13.00	....	....	8.45	Jan. 26	Winnsboro	" "	"
194	Imperial Diss. Bone	12.85	14.89	1.83	10.31	2.75	13.06	....	....	....	8.49	12.00	....	....	7.80	Feb. 9	Abbeville	" "	"
48	LeroySprings H.G.Diss.Bone	14.00	14.66	.74	11.88	2.04	13.92	....	....	....	9.05	13.00	....	....	8.45	Feb. 5	Chester	" "	"
45	Macmurphy's H.G.Acid Phos	15.26	14.75	.24	12.35	2.16	14.51	....	....	....	9 43	13.00	....	....	8.45	Feb. 1	Rock Hill	The W.C. Macmurphy Co	Charleston, S. C.
158	Premium Diss. Bone	13 17	14.35	2.17	8.25	3 93	12.18	....	....	....	7.92	13.00	....	....	8.45	Jan. 24	Westminster	Richmond Guano Co	Richmond, Va.
222	Read's Acid Phos	12.85	15.36	1.15	10.98	3.23	14.21	....	....	....	9.24	13.00	....	....	8.45	Jan. 18	Allendale	Read Phos. Co	Charleston, S. C

TABLE II. Acid Phosphates, Without Potash.—Continued.

Sample No.	Brand of Fertilizer	Moisture	FOUND									GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid																
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
112	Richmond H. G. Acid Phos..	13.84	14.90	67	10 95	3.28	14.23	....	....	....	9.25	14.00	....	....	9.10	Jan. 6	Anderson......	Richmond Guano Co....	Richmond, Va.
240	Rose Hill H. G. Acid Phos ..	10.41	15 80	1.00	11.54	3.26	14 80	....	....	....	9.62	13.00	....	....	8 45	Jan. 30	Sumter........	Ashepoo Fert. Co........	Charleston, S. C.
224	Royal Diss. Bone	11 64	14 98	1.70	9.47	3 81	13.28	....	....	....	8.63	12.00	....	....	7 80	Jan. 24	Orangeburg ...	Va.-Carolina Chem. Co..	Richmond, Va.
328	Royal Diss. Bone............	12.76	14 71	1.69	10 99	2.03	13.02	....	....	....	8 46	13 00	....	....	8.45	Jan. 25	Marion	“ “	“
152	Roysters H. G. Diss. Bone ..	14.69	14 72	2 09	7.85	4.78	12.63	....	....	....	8 21	13 00	....	....	8 45	Jan. 23	Easley.........	F. S. Royster Guano Co..	Norfolk, Va.
24	Star Brand Diss. Bone	12.55	15.03	79	12 09	2 15	14 24	....	....	....	9 26	13.00	....	....	8 45	Jan. 18	Chester........	Va.-Carolina Chem. Co..	Richmond, Va.
9	Stono Acid Phos.............	11.30	15 49	1.37	11.55	2 57	14.12	....	....	....	9 18	13 00	....	....	8 45	Dec. 22	Winnsboro	“ “	“
308	Stono Diss. Bone............	13 09	14.49	0.50	11 42	2.57	13.99	....	....	....	9 09	13 00	....	....	8 45	Jan. 17	Cheraw........	“ “	“
172	Swift's H. G. Acid Phos.....	13.79	14 90	3.59	6 61	4 70	11.31	....	....	....	7.35	13.00	....	....	8.45	Jan. 29	Anderson......	Swift Fert Works.......	Atlanta, Ga.
2	Tiger Brand Diss. Bone......	14 84	15 71	72	12.22	2 77	14.99	....	....	....	9 74	13 00	....	....	8.45	Dec. 19	Spartanburg...	Spartanburg Fert. Co....	Spart'nburg, S.C.
137	Traver's Diss. Bone..........	12.85	14.16	1 75	9.15	3 26	12.41	....	....	....	8 07	12 00	....	....	7.80	Jan. 19	Greers.........	Va.-Carolina Chem. Co..	Richmond, Va.
225	Wagener & Co.'s Diss. Bone	12.73	14 56	2.18	8.03	4.35	12 38	....	....	....	8.05	13 00	....	. ..	8 45	Jan. 24	Orangeburg ...	“ “	“
115	Wando Diss. Bone...........	13.95	15.05	2.29	10 36	2 40	12.76	....	....	....	8 29	13.00	....	....	8.45	Jan. 8	Anderson......	“ “	“
253	Wando Diss. Bone...........	14.04	14 30	.73	10.72	2.85	13 57	....	....	....	8.82	12 00	....	....	7.80	Feb. 12	Blackville	“ “	“

TABLE III. Acid Phosphate, With Potash.

Sample No.	Brand of Fertilizer	Moisture	FOUND									GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid					Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
			Total	Insoluble	Soluble	Reverted	Available												
142	Alkaline Bone	14.25	10.97	1.20	6.96	2.81	9.77	....	....	2.12	8.26	10.00	....	2.00	8.30	Jan. 22	Greenville	Richmond Guano Co.	Richmond, Va.
169	Alkali Bone	13.50	12.98	.84	7.97	4.17	12.14	...	....	2.01	9.70	11.00	....	2.00	8.95	Jan. 29	Anderson	The Pocomoke Guano Co	Norfolk, Va.
109	Ashley Acid Phos	12.05	13.79	1.06	10.50	2.23	12.73	....	....	2.14	10.20	10.00	....	2.00	8.30	Jan. 6	Anderson	Va.-Carolina Chem. Co.	Richmond, Va
129	At. & V. F. Co.'s Acid Phos.	12.76	12.86	2.58	8.26	2.02	10.28	....	....	2.21	8.67	10.00	....	2.00	8.30	Jan. 15	Anderson	" "	"
44	Atlantic Acid Phos.	12.68	12.09	1.68	5.68	4.73	10.41	...	....	2.43	8.95	10.00	....	2.00	8.30	Feb. 1	Rock Hill	" "	"
210	Baldwin's F. Co.'s Acid Phos.	10.45	13.02	2.41	7.60	3.01	10.61	....	....	2.00	8.70	10.00	....	2.00	8.30	Jan. 8	Edgefield	" "	"
143	Bone and Potash Mixture	14.11	11.24	1.38	6.35	3.51	9.86	....	....	2.06	8.26	10.00	....	2.00	8.30	Jan. 22	Greenville	Powatan Chem. Co.	Norfolk, Va.
22	Chicora Acid Phos.	13.06	12.92	1.28	6.26	5.38	11.46	....	....	1.77	9.16	10.00	....	2.00	8.30	Jan. 18	Chester	Va.-Carolina Chem. Co.	Richmond, Va.
183	Chicora Acid Phos.	9.46	11.68	1.94	2.35	7.39	9.74	....	....	3.90	9.84	8.00	....	4.00	8.80	Feb. 6	Lowndesville	" "	"
26	Cotton Brand Acid Phos.	13.25	13.48	1.51	7.48	4.49	11.97	....	....	2.48	10.01	10.00	....	2.00	8.30	Jan. 18	Chester	" "	"
6	Edisto Acid Phos. (11-2)	12.29	12.31	2.07	7.20	3.04	10.24	....	....	2.22	8.65	10.00	....	2.00	8.30	Dec. 21	Union	" "	"
161	Edisto Acid Phos. (11-1)	14.07	13.28	1.65	8.47	3.16	11.63	....	....	1.00	8.46	11.00	....	1.00	8.05	Jan. 25	Autun	" "	"
230	Edisto Acid Phos. (12-1)	11.25	13.16	.63	9.98	2.55	12.53	....	....	1.27	9.29	12.00	....	1.00	8.70	Jan. 25	Camden	" "	"
17	Enoree Acid Phos	10.61	12.97	1.92	9.44	1.61	11.05	....	....	2.55	9.48	10.00	....	2.00	8.30	Jan. 17	Winnsboro	Ashepoo Fert. Co.	Charleston, S. C.
18	Eutaw Acid Phos.	10.93	13.84	.77	9.71	3.36	13.07	....	....	1.23	9.60	11.00	....	1.00	8.05	Jan. 17	Winnsboro	" "	"
128	Globe Acid Phos.	11.13	13.48	2.74	5.73	5.01	10.74	....	....	1.24	8.10	10.00	....	1.00	7.40	Jan. 15	Anderson	Va.-Carolina Chem. Co.	Richmond, Va.
227	Imperial Acid Phos.	12.91	13.25	.97	9.33	2.95	12.28	....	....	1.42	9.26	12.00	....	1.00	8.70	Jan. 25	Camden	" "	"
49	Leroy Springs Acid Phos.	10.90	12.15	1.77	8.06	2.32	10.38	....	....	4.08	10.42	10.00	....	4.00	10.10	Feb. 5	Chester	" "	"
33	Macmurphy's Ac. Phos. & Pot.	12.66	11.53	.77	8.16	2.60	10.76	....	....	2.23	9.00	10.00	....	2.00	8.30	Jan. 24	Chester	The W. C. Macmurphy Co	Charleston, S. C.
147	Navassa Acid Phos. with Pot.	12.43	12.79	2.35	3.79	6.65	10.44	....	....	1.52	8.15	10.00	....	2.00	8.30	Jan. 23	Easley	Navassa Guano Co.	Wilmingt'n, N. C.
236	Navassa Acid Phos. with Pot.	13.51	14.01	1.51	8.46	4.04	12.50	....	....	1.32	9.31	12.00	....	1.00	8.70	Jan. 30	Sumter	" "	"
43	Palmetto Acid Phos.	9.88	14.05	.58	10.31	3.16	13.47	....	....	1.30	9.93	11.00	....	1.00	8.05	Feb. 1	Rock Hill	Ashepoo Fert. Co.	Charleston, S. C.
251	Read's Bone and Potash	14.20	12.61	.58	9.01	3.02	12.03	....	....	1.67	9.32	11.00	....	1.00	8.05	Feb. 12	Blackville	Read Phosphate Co	"
38	Royal Acid Phos.	12.93	13.36	1.55	8.44	3.37	11.81	....	....	1.38	8.92	11.00	....	1.00	8.05	Jan. 27	Chester	Va.-Carolina Chem. Co.	Richmond, Va.
178	Royal Acid Phos.	12.77	12.92	2.92	7.22	2.78	10.00	....	....	2.07	8.36	10.00	....	2.00	8.30	Feb. 1	Starr	" "	"
151	Royster's Bone & Pot. Mixt.	13.91	10.90	1.17	6.42	3.31	9.73	....	....	2.39	8.48	10.00	....	2.00	8.30	Jan. 23	Easley	F. S. Royster Guano Co.	Norfolk, Va.
157	Seneca H. G. Acid Phos.	16.68	12.93	.26	10.49	2.18	12.67	....	....	1.36	9.46	12.00	....	1.00	8.70	Jan. 24	Seneca	Seneca Fert. Co.	Seneca, S. C.

TABLE III. Acid Phosphate, With Potash.—Continued.

Sample No.	Brand of Fertilizer	Moisture	Found									Guaranteed				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid																
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
47	Standard Grade Acid Phos..	14 43	12.61	.78	9.26	2 57	11.83	....	....	2 09	9 57	10 00	....	2.00	8 30	Feb. 5	Chester........	Va.-Carolina Chem. Co..	Richmond, Va.
233	Stono Acid Phos.............	14.75	11 44	.32	9 17	1 95	11.12	....	....	2.73	9.69	10.00	....	2.00	8.30	Jan. 25	Camden	" "	"
56	Stono Acid Phos..............	12 80	11.21	1.16	7 16	2.89	10 05	....	....	1 59	7.96	11.00	...	1.00	8 05	Feb. 6	Johnston	" "	"
226	Wagener & Co.'s Acid Phos..	13 66	13 26	2.72	6.14	4 40	10.54	....	....	1.21	7 94	11.00	....	1.00	8.05	Jan. 24	Orangeburg....	" "	"
123	Wando Acid Phos.	13.36	12.61	2.58	8.01	2.02	10.03	....	....	2 26	8.55	10.00	....	2.00	8.30	Jan. 15	Anderson	" "	"

TABLE IV. Cotton Seed Meals.

Sample No.	Manufacturer or Dealer	Found										Guaranteed				Date Sampled	Manufactured At
		Moisture	Phosphoric Acid					Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton		
			Total	Insoluble	Soluble	Reverted	Available										
117	Abbeville Oil and Fert. Co.	6.45	2.44	.19	1.25	1.00	2.25	7.51	9.12	1.63	23.45	......	7.00	......	15.75	Jan. 11	Abbeville, S. C.
102	Anderson Oil and Fert. Co.	5.75	2.17	.18	1.23	.76	1.99	7.64	9.28	1.61	23.62	......	7.50	......	16.87	Jan 2	Anderson, S. C.
241	Atlantic Cotton Oil Co.	7.89	2.57	.17	1.32	1.08	2.40	6.19	7.52	1.63	19.95	2.00	7.50	1.00	19.07	Jan. 31	Sumter, S. C.
103	Belton Oil Mill	6.43	2.25	.19	1.20	.86	2.06	7.49	9.09	1.54	23.18	......	7.00	......	15.75	Jan. 4	Belton, S. C.
10	Chester Oil Mill	6.60	2.56	.14	1.24	1.18	2.42	7.11	8.63	1.61	22.44	......	7.50	......	16.87	Dec. 23	Chester, S. C.
118	Coronaca Milling Co.	8.62	2.39	.17	1.18	1.04	2.22	7.14	8.67	1.51	22.31	......	7.00	......	15.75	Jan. 17	Coronaca, S. C.
334	Darlington Oil Co	7.13	2.78	.19	1.32	1.27	2.59	7.28	8.84	1.74	23.14	......	8.00	......	18.00	Jan. 26	Darlington, S. C.
146	Easley Oil Mill Co	6.17	2.43	.18	1.30	.95	2.25	7.51	9.12	1.50	23.33	......	8.00	......	18.00	Jan. 23	Easley, S. C.
212	Edgefield Mfg. Co.	8.45	2.32	.20	1.05	1.07	2.12	7.51	9.12	1.60	23.34	......	8.00	......	18.00	Jan. 8	Edgefield, S. C.
312	Elberton Oil Mill	5.75	2.33	.17	1.10	1.06	2.16	7.79	9.46	1.70	24.22	......	8.00	......	18.00	Jan 22	Elberton, Ga.
101	Excelsior Oil Mill	7.19	2.24	.22	1.33	.69	2.02	7.46	9.06	1.49	23.04	......	7.50	......	16.87	Jan. 2	Anderson, S. C.
8	Fairfield Oil and Fert. Co.	7.94	2.21	.14	1.39	.68	2.07	6.99	8.49	1.50	21.80	......	7.00	......	15.75	Dec 22	Winnsboro, S. C.
140	Fairforest Oil Mill	7.78	2.21	.18	1.18	.85	2.03	7.41	9.00	1.57	22.98	......	7.00	......	15.75	Jan. 19	Fairforest, S. C.
134	Fountain Inn Oil Mill	8.00	2.19	.18	1.16	.85	2.01	6.40	7.77	1.58	20.21	......	7.00	......	15.75	Jan 18	Fountain Inn, S. C.
133	Gray Court C. Oil Mill	6.36	2.28	.18	1.24	.86	2.10	6.69	8.12	1.64	21.11	......	7.00	......	15.75	Jan. 18	Gray Court, S. C.
119	Greenwood Oil Mill	7.20	2.35	.17	1.07	1.11	2.18	7.68	9.32	1.55	23.78	2.00	8.00	1.00	20.20	Jan. 12	Greenwood, S. C.
138	Greers Oil and Fert. Co.	7.21	2.43	.19	1.27	.97	2.24	7.65	9.29	1.65	23.84	......	7.50	......	16.87	Jan. 19	Greers, S. C.
105	Honea Path Oil Mill Co.	7.01	2.21	.17	1.14	.90	2.04	6.88	8.35	1.49	21.45	......	7.00	......	15.75	Jan. 4	Honea Path, S. C.
228	Interstate Cotton Oil Co.	8.86	2.35	.18	1.23	.94	2.17	6.89	8.36	1.62	21.68	......	7.50	......	16.87	Jan. 25	Augusta, Ga.
213	Kathwood Mfg. Co.	8.47	2.55	.17	1.34	1.04	2.38	6.37	7.74	1.62	20.42	......	7.50	......	16.87	Jan. 9	Kathwood, S. C.
130	Laurens Oil and Fert. Co.	7.68	2.33	.18	1.11	1.04	2.15	7.42	9.01	1.55	23.07	......	8.00	......	18.00	Jan. 17	Laurens, S. C.
145	Liberty Oil Mill and Mfg Co.	6.25	2.30	.20	1.25	.85	2.10	7.63	9.26	1.60	23.64	1.50	8.00	1.00	19.87	Jan. 23	Liberty, S. C.
116	Lowndesville C. Oil Co.	7.51	2.35	.18	1.04	1.13	2.17	7.14	8.67	1.62	22.38	......	7.50	......	16.87	Jan. 9	Lowndesville, S. C.
332	Marion Oil Mill Co.	6.67	2.81	.18	1.42	1.21	2.63	7.17	8.70	1.83	22.93	......	7.00	......	15.75	Jan. 25	Marion, S. C.
106	Moneynick Oil Mill	6.16	2.12	.18	1.22	.72	1.94	7.23	8.78	1.67	22.52	......	8.00	......	18.00	Jan. 5	Pelzer, S. C.
120	Newberry Oil and Fert. Co.	8.58	2.57	.18	1.23	1.16	2.39	7.28	8.84	1.59	22.87	......	8.00	......	18.00	Jan 13	Newberry, S. C.
201	Orangeburg Oil Mill	7.67	2.85	.20	1.34	1.31	2.65	6.57	7.98	1.72	21.23	......	7.50	......	16.87	Jan. 3	Orangeburg, S. C.

TABLE IV. Cotton Seed Meals.—Continued.

Sample No.	Manufacturer or Dealer	FOUND										Guaranteed				Date Sampled	Manufactured At
		Moisture	Phosphoric Acid					Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton		
			Total	Insoluble	Soluble	Reverted	Available										
1	Produco Mills	7.69	2.38	.22	1.45	.71	2.16	7.64	9.28	1.70	23.81	......	7.00	......	15.75	Dec. 19	Spartanburg, S. C.
15	Ridge Spring Oil Mill	7.65	2.57	.19	1.09	1.29	2.38	7.22	8.77	1.63	22.75	......	8.00	......	18.00	Jan. 15	Ridge Spring, S. C.
104	Saluda Oil Mill	7.50	2.15	.17	1.19	.79	1.98	7.50	9.11	1.44	23.08	......	7.00	......	15.75	Jan. 4	Piedmont, S. C.
202	St. Matthews Mfg. and W. Co.	8.04	2.80	.19	1.51	1.10	2.61	6.53	7.93	1.70	21.07	......	7.00	......	15.75	Jan. 4	St. Matthews, S. C.
153	Seneca Oil Mill	8.20	2.33	.19	1.24	.90	2.14	7.20	8.74	1.61	22.51	......	7.50	......	16.87	Jan. 24	Seneca, S. C.
132	Simpsonville Oil Mill	6.98	2.33	.20	1.06	1.07	2.13	7.45	9.05	1.69	23.27	......	7.00	......	15.75	Jan. 17	Simpsonville, S. C.
204	Southern Cotton Oil Co.	7.84	2.58	.17	1.37	1.04	2.41	6.43	7.81	1.76	20.72	1.50	7.00	1.00	17.62	Jan. 6	Barnwell, S. C.
216	Southern Cotton Oil Co.	8.41	2.47	.18	1.43	.86	2.29	6.71	8.15	1.62	21.28	......	8.00	......	18.00	Jan. 16	Savannah, Ga.
304	Southern Cotton Oil Co.	6.62	2.70	.18	1.41	1.11	2.52	7.06	8.57	1.74	22.49	1.50	7.50	1.00	18.75	Jan. 15	Columbia, S. C.
141	S. C. Cotton Oil Co.	6.77	2.23	.19	1.07	.97	2.04	7.36	8.94	1.69	22.96	......	7.50	......	16.87	Jan. 22	Greenville, S. C.
302	S. C. Cotton Oil Co.	7.20	2.61	.19	1.39	1.03	2.42	6.91	8.39	1.81	22.08	1.50	7.50	1.00	18.75	Jan. 15	Columbia, S. C.
139	Tyger Shoals Milling Co.	7.81	2.20	.20	1.06	.94	2.00	7.42	9.01	1.50	22.92	......	7.50	......	16.87	Jan. 19	Duncans, S. C.
7	Union Oil and Mfg. Co.	7.56	2.51	.13	1.34	1.04	2.38	7.06	8.57	1.64	22.31	......	7.50	......	16.87	Dec. 21	Union, S. C.
5	Victor Cotton Oil Co.	5.87	2.33	.19	1.15	.99	2.14	7.72	9.37	1.70	24.00	......	7.50	......	16.87	Dec. 20	Gaffney, S. C.
107	Williamston Oil Mill	6.75	2.26	.18	1.23	.85	2.08	7.73	9.38	1.62	23.92	......	8.00	......	18.00	Jan. 5	Williamston, S. C.
131	Woodruff Oil Mill	7.52	2.32	.22	1.10	1.00	2.10	7.51	9.12	1.56	23.29	......	7.50	......	16.87	Jan. 17	Woodruff, S. C.

TABLE V. Kainit.

Sample No.	IMPORTER OR DEALER	FOUND		GUARANTEED		Date Sampled	SAMPLED AT	IMPORTER OR DEALER	ADDRESS
		Potash Soluble in Water	Relative Com. Value per Ton	Potash Soluble in Water	Relative Com. Value per Ton				
205	Ashepoo Fert. Co	12.80	11.52	12.00	10.80	Jan. 6	Barnwell	Ashepoo Fert Co	Charleston, S. C.
32	Calder Bros	12.98	11.68	12.00	10.80	Jan. 23	Chester	Calder Bros	Wilmington, N. C.
187	F. S. Royster Guano Co	13 02	11.72	12.00	10.80	Feb. 7	Troy	F. S. Royster Guano Co	Norfolk, Va.
237	Navassa Guano Co	12.14	10.93	12.00	10.80	Jan. 30	Sumter	Navassa Guano Co	Wilmington, N. C.
333	The W. C. Macmurphy Co	12.29	11 06	12.00	10.80	Jan. 25	Marion	The W. C. Macmurphy Co	Charleston, S. C.
11	Va.-Carolina Chemical Co	13.07	11.76	12.00	10.80	Dec. 28	Rock Hill	Va.-Carolina Chemical Co	Richmond, Va

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BULLETIN 54. JUNE, 1900.

South Carolina Agricultural Experiment Station.

Clemson Agricultural College.

(S. C. A. & M. COLLEGE.)

ANALYSIS OF COMMERCIAL FERTILIZERS.

PART II.

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ANNALYSIS OF COMMERCIAL FERTILIZERS.

PART II.

Season of 1899-1900.

This bulletin completes the report of analyses of fertilizers for this season. Three hundred and thirty official samples have been collected and analyzed. One hundred and seventy-six analyses were reported in Bulletin No. 53, issued in April, and the analyses of one hundred and fifty-four are reported herein.

The commercial valuations of raw materials for this season are as follows:

	Per Unit.	Per. Pound.
Phosphoric Acid (available)	$ .65	$.03 1-4
Ammonia in Sulp. Ammonia	2.60	.13
Ammonia, Equiv. to Nitrogen, in Nit. Soda	2.35	.11 3-4
Ammonia, Equiv. to Nitrogen, in D. Blood	2.50	.12 1-2
Ammonia, Equiv. to Nitrog'n, in C.S. Meal	2.25	.11 1-4
Potash in Muriate of Potash	.90	.04 1-2
Potash in Kainit	.90	.04 1-2
Potash in Sulphate of Potash	1.00	.05

In mixed fertilizers the ingredients are reckoned as follows:

	Per Unit.	Per. Pound.
Phosphoric Acid (available)	$ .65	$.03 1-4
Ammonia	2.40	.12
Potash, Soluble in water	.90	.04 1-2

For information in regard to the composition of commercial fertilizers, and the requirements of our State laws in the sale of commercial fertilizers, and the analysis of farmers' samples, see Bulletin No. 53, issued in April, 1900.

TABLE I. Ammoniated Fertilizers.

Sample No.	Brand of Fertilizer	Moisture	Found									Guaranteed				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid					Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
			Total	Insoluble	Soluble	Reverted	Available												
430	Adair's Amm. Bone........	11.27	11.30	1.66	6.52	3.12	9 64	1 84	2.23	2.16	13 56	8.50	2.00	2.00	12.12	Feb 28	Easley.........	A D Adair & McCarty Bro	Atlanta, Ga.
200	Almont Amm. Sol. Guano.	11.43	12.79	2.02	7.30	3 47	10.77	1 65	2.01	1.37	13.06	8.50	2.00	2.00	12.12	Feb 19	Anderson......	Va.-Caro. Chemical Co.	Richmond, Va.
257	Armour's 5-8-3 Fertilizer...	5.99	11.62	.68	3.02	7.92	10 94	4.46	5.41	3.47	23 22	8.00	5.00	3.00	19 90	Feb 12	Blackville	Armour Packing Co.	Kansas City, Mo.
256	Armour's 3-8-6 Fertilizer...	5 66	12.28	.82	3.43	8.03	11 46	2.65	3.22	5.90	20.49	8.00	3.00	6.00	17.80	Feb 12	Blackville	Armour Packing Co......	"
457	Arrow Brand Guano.......	16.05	10.93	.99	5.80	4.14	9.94	1 98	2.41	1.15	13.28	8.00	2.50	1.00	12.10	Feb 26	Cowpens	F. S. Royster Guano Co..	Norfolk, Va.
468	Ashepoo X. X. Guano......	13.75	10.80	1.05	7.15	2.60	9.75	1 91	2.32	2 37	14 04	8.50	2.00	2 00	12.12	Mar 1	Campobello....	Ashepoo Fert. Co........	Charleston, S. C.
289	Ashley Complete Fert......	13.35	11.62	2.17	6.59	2.86	9.45	1 90	2.31	1.23	12.79	8.00	2.50	1.00	12.10	Mar 10	Denmark	Va.-Caro. Chemical Co..	Richmond, Va.
282	Atlantic Fertilizer.........	13 64	12.23	3.35	6.73	2.15	8.88	2.31	2.80	1.51	13 85	8.00	2.50	1.00	12.10	Mar 2	Elloree	" "	"
467	Atlantic High Grd Sol Gua.	15.37	10.02	.97	6.55	2.50	9.05	1.77	2.15	2 11	12.94	8.50	2.00	2.00	12.12	Feb 27	Cowpens	Atlantic Chemical Co....	Norfolk, Va.
258	Augusta Amm. Diss. Bone.	11.90	11 56	1.41	6.35	3.80	10.15	1.81	2.20	1.53	13.25	9.00	2.00	1.60	12.09	Feb 12	Blackville	Augusta Guano Co.......	Augusta, Ga.
63	Augusta High Grd Guano..	9 92	12.65	1.62	7.69	3.34	11.03	2.07	2.52	2 13	15.13	9.50	2.50	2.00	13.97	Feb 7	Ridge Spring..	" "	"
460	Beef Blood and Bone Fert.	13.15	10 29	.86	7.04	2 39	9.43	1.75	2 13	1.10	12.23	8.00	2.00	1.00	10.90	Feb 26	Cowpens	Va.-Car. Chemical Co. ..	Richmond, Va.
255	Berkeley Complete Fert...	13.48	12.79	3.16	6.59	3.04	9.63	2.09	2.54	1.27	13.50	8.00	2.50	1.00	12.10	Feb 12	Blackville	Va.-Carolina Chem. Co..	Richmond, Va
436	Blue Ridge Guano.........	10.31	10.30	1.32	6.41	2.57	8.98	2.26	2.75	1.60	13.88	8.00	2.50	1.00	12.10	Mar 5	Seneca........	M W Coleman & Co......	Seneca, S. C.
450	Bone and Peruvian Guano	18.70	10.31	1.77	5.25	3.29	8.54	2.03	2.47	1.97	13.25	8.00	2.00	2.00	11.80	Mar 21	Greenwood.....	American Fert. Co..	Norfolk, Va.
445	Bowker's Nassau Guano...	15.61	11.04	1.45	5.76	3.83	9.59	1.80	2.19	2.25	13.51	8 50	2.00	2.00	12.12	Mar 14	Verdery	Bowker Fert. Co.........	Savannah, Ga.
457A	Bright Leaf Tob. Grower..	11.12	12.52	3.98	6.37	2.17	8.54	2.40	2.92	3.01	15.27	8.00	3.00	3.00	15 10	Mar 2	Marion	Va.-Car. Chem. Co	Richmond, Va.
65	Bradley's Amm. Diss. Bone	13.55	11.36	1.10	7.65	2.61	10.26	1.95	2.37	1.23	13.46	9.00	2.25	1.00	12.15	Feb 8	Leesville	Bradley Fert. Co.........	Charleston, S. C.
401	Brock's Cotton Fertilizer..	10.13	10.66	.91	8.07	1.68	9.75	2 21	2.68	1.35	13.98	8.00	2.50	1.00	12.10	Feb 20	Honea Path....	Brock Fert. Co	Honea Path, S. C
422	Capital Cotton Fertilizer..	10.60	12.41	2.79	6.06	3.56	9.62	2.19	2.66	1.13	13.65	8 00	2.50	1.00	12.10	Feb 27	Greers.........	Va.-Carolina Chem. Co..	Richmond, Va.
350	Carolina Tobacco Guano..	8.45	12.67	2.89	5.99	3.79	9.78	2.66	3.23	3.00	16.81	8.00	3.00	3.00	15.10	Feb 7	Darlington.....	" "	"
59	Carolina Amm. Bone......	14.86	11.05	1.66	7.62	1.77	9.39	1.96	2.38	1.44	13.11	8.00	2.50	1.00	12.10	Feb 7	Batesburg......	" "	"
99	Charlotte Amm. Fertilizer.	7.76	9.08	.83	5.08	3.17	8.25	2.69	3.27	2.35	15.33	8.00	2.50	1 50	12.55	Feb 24	Gaffney........	Charlotte Oil & Fert. Co.	Charlotte, N. C.
193	Cherokee High Grd Am Frt	12.24	12.84	2.43	6.84	3.57	10.41	1.96	2.38	1.29	13 64	8.00	2.50	1.00	12.10	Feb 9	Abbeville......	Va.-Caro. Chemical Co..	Richmond, Va.
464A	Chicora Amm. Diss. Bone.	14.46	11.81	2.16	7.39	2.26	9.65	1.84	2.24	2.16	13.59	8.00	2.00	2 00	11.80	Mar 14	McColl	" "	"
400	Chicora Tobacco Grower..	10.87	11.83	3.63	5.81	2.39	8.20	2.53	3.07	3.61	15.95	8.00	3.00	3 00	15.10	Mar 2	Marion	" "	"
460A	Cinco Tobacco Guano....	9.59	11.82	1.14	7.34	3.34	10.68	2.00	2.43	3.01	15.48	8 50	2.50	2.50	14.22	Mar 3	Marion	Pocomoke Guano Co....	Norfolk, Va.

TABLE I. Ammoniated Fertilizers.—Continued.

Sample No.	Brand of Fertilizer	Moisture	FOUND									GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid																
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
76	Columbia Soluble Guano..	17.01	11.36	.88	6 24	4.24	10.48	1.65	2.01	2.12	13.54	8.50	2.00	2.00	12.12	Feb 16	Spartanburg...	Columbia Guano Co.....	Norfolk, Va.
79	Columbia Amm. Fert......	11.17	11.46	1.65	6.68	3.13	9.81	1.82	2.21	1.78	13.28	8.50	2.00	2.00	12.12	Feb 19	Inman.........	Va.-Carolina Chem. Co..	Richmond, Va.
453B	Conneross Guano	12.34	10.94	.91	8.12	1.91	10.03	1.74	2.11	2.53	13.86	9.00	2.00	2 00	12.45	Mar 27	Seneca	Seneca Fert. Co.........	Seneca, S. C.
410	Edisto Amm. Fertilizer....	9.30	11.74	1.91	5.65	4.18	9.83	1.85	2.25	1.02	12.71	8 00	2.50	1.00	12.10	Feb 23	Simpsonville ..	Va.-Caro. Chemical Co..	Richmond, Va.
263	Edisto Amm. Diss. Bone...	12.16	11.85	2.39	7.20	2.26	9.46	1.61	1.95	2.23	12.84	8 50	2.00	2.00	12.12	Feb 15	Allendale......	“ “	“
68	Electric Crop Grower.	10.91	10.36	1.27	6.19	2.90	9.09	1.65	2.01	2.04	12.57	8.50	2.00	2.00	12.12	Feb 8	Leesville	Pocomoke Guano Co....	Norfolk, Va.
456	Eureka Amm. Bone	13.28	11.45	1.23	7.75	2.47	10.22	1.65	2.01	2.01	13.28	8.50	2.00	2.00	12.12	Feb 26	Cowpens	Va -Carolina Chem. Co.	Richmond, Va.
91	Gem Fertilizer............	10.10	12.82	3.89	5.88	3.05	8.93	1.56	1.90	1.92	12.09	8.00	2.00	2.00	11.80	Feb 22	Gaffney........	Acme Mfg. Co.	Wilmington, N.C.
94	Genuine Bone & Per'n Gua	11.98	11.00	1.04	6.69	3.27	9.96	1.65	2.01	2.38	13.44	8.50	2.00	2.00	12.12	Feb 23	Blacksburg	Va.-Carolina Chem. Co..	Richmond, Va.
362	Genuine Slaught'r Hse Bne	15.69	10.72	1.74	6.90	2.08	8.98	1.71	2.08	1.45	12.13	8.50	2.00	2.00	12.12	Apr 2	Santuc	“ “	“
441	Georgia Formula	14.80	11.33	.72	7.97	2.64	10.61	1.57	1.91	2.00	13.28	9.00	2.00	2.00	12.45	Mar 14	Parksville.	Georgia Chemical Works	Augusta, Ga.
196	Gold Dust Guano..........	10.95	9.31	.51	6.65	2.15	8.80	2.64	3.21	1.65	14.91	8.00	2.00	1.00	10.90	Feb 14	Newberry......	Newberry Oil Mill.......	Newberry, S. C.
299	Hunter, P & B's Am Dis Bn	13.39	11.46	1.47	7.64	2.35	9.99	2.63	3.19	1.74	15.72	8.00	2.50	1.00	12.10	Mar 21	Olar...........	Va -Carolina Chem. Co.	Richmond, Va.
77	Hyco Tobacco Guano......	14.64	9.90	.63	5.92	3.35	9.27	2.57	3.12	2.66	15.91	8.00	3.00	3.00	15.10	Feb 16	Spartanburg...	Columbia Guano Co.....	Norfolk, Va.
296	Leffler's Amm. Diss. Bone.	12.29	12.13	2.09	7.80	2.24	10.04	2.19	2.66	1.68	14.42	9.00	2.00	1 00	11.55	Mar 19	Ulmer..........	Va.-Carolina Chem. Co..	Richmond, Va.
485	Leroy Springs Amm. Fert.	13.20	11.95	3.28	6.37	2.30	8.67	2.11	2.56	1.18	12.84	8.00	2.50	1 00	12 10	Mar 12	Chester........	“ “	“
416	Magic Cotton Grower	11.86	11.71	1.47	5.85	4.39	10.24	1.66	2.02	1.78	13.11	8.50	2.00	2.00	12.12	Feb 24	Greenville.....	Powhatan Chem. Co.....	Richmond, Va.
432	Mastodon Amm. Sol. Phos.	9.99	12.91	2.48	6.55	3.88	10.43	2.40	2.92	2.08	15.66	9 00	2.50	2.00	13.65	Mar 3	Denver	Georgia Chem. Co.......	Augusta, Ga.
459 A	Monarch Tobacco Grower.	9.61	12.63	1.30	7.60	3.73	11.33	2.49	3.03	3.02	17.35	8.00	3.00	3.00	15.10	Mar 3	Marion	Pocomoke Guano Co....	Norfolk, Va.
97	Ober's Sp. Amm Diss Bone	11.67	11.74	.92	9.17	1.65	10.82	2.00	2.43	2.37	15.00	9.00	2 00	2.00	12.45	Feb 23	Blacksburg....	G. Ober & Sons Co......	Baltimore, Md.
425	Ober's Far Stand Am Phos	11.20	10.75	.91	8.21	1.63	9.84	2.13	2.59	2.36	14.74	8.00	2.15	2.00	12.16	Feb 27	Greers.........	“ “	“
459	Peruvian Mixture.	16.66	10.18	1.14	6.58	2.46	9.04	1.67	2.03	2.09	12.63	8.00	2.00	1.50	11.35	Feb 26	Cowpens.......	American Fert. Co.......	Norfolk, Va.
67	P. & F. Amm. Fertilizer ...	11.53	10.26	1.04	7.06	2.16	9.22	1.79	2.18	2.25	13.25	9.00	2 00	1.60	12.09	Feb 8	Leesville	Augusta Guano Co.......	Augusta, Ga.
198	Pilot Boy Fertilizer........	9.82	10.01	.73	7.20	2.08	9.28	3.54	4.30	2.77	18.85	9.00	3 50	2.00	16.05	Feb 14	Newberry	Newberry Oil Mill.......	Newberry, S. C.
294	Pineland Trip Pot Am Gua	15.39	11.53	1.19	8 16	2.18	10.34	1.83	2.22	3.26	14.98	9.00	2.00	3.00	13 35	Mar 12	Garnett........	Savannah Guano Co.....	Savannah, Ga.
463A	Powers G & Co's H G A G.	14.60	12.92	2.89	7.39	2.64	10.03	2.13	2.59	1.69	14.26	8.00	2.50	1 00	12.10	Mar 14	McColl	Va.-Carolina Chem. Co..	Richmond, Va.
468A	Read's Tobacco Leaf......	8.74	9.79	1.19	5.50	3.10	8.60	2.48	3.01	4.12	16.52	8.00	3.00	3.00	15.10	Mar 23	Marion	Read Phos. Co..........	Charleston, S. C.

TABLE I. Ammoniated Fertilizers.—Continued.

Sample No.	Brand of Fertilizer	Moisture	FOUND									GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid																
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
403	Saluda Soluble Guano.....	10.03	10.75	.70	8.09	1.96	10.05	1.74	2.11	1.32	12.78	8.00	2.00	1.00	10.90	Feb 20	Honea Path....	Brock Fert. Co..........	Honea Path, S. C
463	Soluble Pacific Guano.....	13.45	11.31	1.01	8.00	2.30	10.30	1.98	2.40	1.21	13.54	9.00	2.25	1.00	12.15	Feb 26	Cowpens.......	Pacific Guano Co........	Charleston, S. C.
394	Special 8-2-2 Cot & Crn Gua	13.01	10.08	.60	7.10	2.38	9.48	1.91	2.32	2.44	13.93	8.00	2.00	2.00	11 80	Feb 22	Cheraw........	W. C. Macmurphy Co....	"
315	Special 8-3-3 Tobacco Guan	11.87	10.20	.72	7.84	1.64	9.48	2.47	3.00	3.08	16.13	8.00	3.00	3.00	15 10	Jan 23	Mandeville....	W. C. Macmurphy Co....	Charleston, S. C.
579	Standard Amm Fertilizer..	12.22	12.38	2.87	6.91	2.60	9.51	2.21	2.68	1.34	13.82	8.00	2.50	1.00	12.10	Mar 27	St. Matthews..	Va.-Carolina Chem. Co..	Richmond, Va.
417	Star Brand Guano........	12.49	13.13	2.61	7.10	3.42	10.52	1.70	2.06	1.57	13.20	8.50	2.00	2.00	12.12	Feb 26	Duncans.......	" "	"
71	Standard Amm. Compound	10.21	9.58	1.22	5.74	2.62	8.36	2 12	2.57	2.01	13.41	8.00	2.50	1.25	12.32	Feb 16	Union..........	Union Oil & Mfg. Co....	Union, S. C.
347	Stono Special for Tobacco.	12.74	11.13	.93	8.79	1.41	10.20	2.07	2.52	3.35	15.69	8 00	3.00	3.00	15 10	Feb 6	Breedens......	Va.-Carolina Chem. Co..	Richmond, Va.
406	Stonewall Guano..........	12.61	12.37	2.21	6.88	3.28	10.16	2.07	2.51	2.03	14.46	8.50	2 00	2 00	12.12	Feb 20	Honea Path....	" "	"
433	Strothers Compound......	11 15	10.36	.73	7.46	2.17	9.63	2.34	2.84	1.54	14.46	8 00	2 50	1.00	12.10	Mar 5	West Union....	W. A. Strother..........	West Union, S. C
473	The Leader................	8.52	7.66	.28	4.57	2.81	7.38	2.56	3.11	2 83	14.81	8.00	2 00	2.00	11.80	Mar 7	Cross Hill.....	Charlotte Oil & Fert. Co.	Charlotte, N. C.
471	Tiger Brand Boll Buster...	10.74	10.52	.64	8.03	1.85	9.88	1.93	2.35	2.15	14.00	9 00	2.00	2 00	12 45	Mar 2	Spartanburg...	Spartanburg Fert. Co....	Spartanburg, S C
424	Travers Special Tob. Fert.	12 96	11.97	2.56	6.59	2.82	9.41	1.82	2.21	1.72	12.97	8 50	2.00	2.00	12.12	Feb 27	Greers.........	Va.-Carolina Chem. Co..	Richmond, Va.
274	Wagener & Co.'s H G A F.	14.82	10 98	2.49	6.18	2.31	8.49	2.16	2.62	1.29	12.97	8.00	2.50	1 00	12 10	Feb 21	Lodge.........	" "	"
453	Wando Soluble Guano.....	12.28	9.83	.74	6.56	2.53	9.09	1.65	2.01	1.02	11.65	8.00	2.00	1.00	10.90	Feb 26	Cowpens......	" "	"
370A	Swift's Golden Harv. Gua.	10 45	10.54	2.02	4.84	3.68	8.52	2.48	3.01	2.06	14.62	8.00	2.50	1.00	12 10	May 22	Greenwood....	Swift Fert. Works......	Atlanta, Ga.

TABLE II. Acid Phosphates, Without Potash.

Sample No.	Brand of Fertilizer	Moisture	FOUND								GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid															
			Total	Insoluble	Soluble	Reverted	Available	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
92	Acme Acid Phosphate	14.43	15.33	1.82	10.96	2.55	13.51	....	....	8.78	13.00	....	....	8.45	Feb 22	Gaffney	Acme Mfg. Co.	Wilmington, N C.
81	Ashley Diss. Bone	14.46	14.71	.87	7.16	6.68	13.84	....	....	9.00	12.00	...	....	7.80	Feb 19	Inman	Va.-Carolina Chem. Co.	Richmond, Va.
259	Augusta G. Co.'s Diss. Bone	11.26	16.06	.84	12.09	3.13	15.22	....	....	9.89	13.00	....	....	8.45	Feb 12	Blackville	Augusta Guano Co.	Augusta, Ga.
435	Blue Ridge Acid Phos.	14.84	14.74	1.18	10.17	3.39	13.56	....	....	8.81	13.00	....	....	8.45	Mar 5	Seneca	M. W. Coleman & Co	Seneca, S. C.
100	Charlotte Diss. Bone	12.16	14.62	1.09	8.51	5.02	13.53	....	....	8.79	12.00	....	....	7.80	Feb 24	Gaffney	Charlotte Oil & Fert. Co.	Charlotte, N. C.
446	Columbia Acid Phos.	14.54	13.27	1.45	5.67	6.15	11.82	....	....	7.68	12.00	....	....	7.80	Mar 14	Verdery.	Columbia Guano Co.	Norfolk, Va.
472	Charlotte Acid Phos	15.58	13.48	.68	7.75	5.05	12.80	....	....	8.32	13.00	....	....	8.45	Mar 7	Cross Hill	Charlotte Oil & Fert. Co.	Charlotte, N. C.
414	Columbia Diss. Bone	13.07	14.61	1.14	9.84	3.63	13.47	....	....	8.76	12.00	....	....	7.80	Feb 24	Gray Court	Va.-Carolina Chem. Co.	Richmond, Va.
477	Edisto Diss. Bone	13.35	13.23	.50	10.08	2.65	12.73	....	....	8.27	12.00	....	....	7.80	Mar 7	Mountville	" "	"
455	Eureka Diss. Bone	8.11	14.55	1.02	9.27	4.26	13.53	....	....	8.79	12.00	....	....	7.80	Feb 26	Cowpens	" "	"
461	High Grade Acid Phos.	13.25	16.72	1.74	10.77	4.21	14.98	....	....	9.74	14.00	....	....	9.10	Feb 26	Cowpens	American Fert. Co.	Norfolk, Va.
88	Navassa Diss. Bone	11.58	15.61	1.41	10.67	3.53	14.20	....	....	9.23	13.00	....	....	8.45	Feb 22	Gaffney	Navassa Guano Co	Wilmington, N.C.
454	Navassa Diss. Bone	14.10	13.92	1.27	8.10	4.55	12.65	....	....	8 22	12.00	....	....	7.80	Feb 26	Cowpens	" "	"
429	Ober's Diss. Bone Phos.	12.75	16.66	.81	12.69	3.16	15.85	....	....	10.30	14.00	....	....	9.10	Feb 28	Liberty	G. Ober & Sons Co.	Baltimore, Md.
462	Pacific Acid Phos.	10.40	15.12	.74	10.64	3.74	14.38	....	....	9.35	12.00	....	....	7.80	Feb 26	Cowpens	Pacific Guano Co	Charleston, S. C.
415	Powhatan Acid Phos.	14.29	14.66	1.45	7.70	5.51	13.21	....	....	8 59	13.00	....	....	8.45	Feb 24	Greenville	Powhatan Chem. Co.	Norfolk, Va.
87	Peerless Acid Phos	11.29	16.20	.82	11.15	4.23	15.38	....	....	10.00	14.00	....	....	9 10	Feb 22	Gaffney	The Pocomoke Guano Co	"
270	Read's Matchless Acid Phos.	12.58	14.35	.68	10.72	2.95	13.67	....	....	8.89	12.00	....	....	7.80	Feb 17	Brunson	Read Phos. Co.	Charleston, S. C.
96	Richmond Diss. S. C. Phos.	14.09	13.41	1.78	6.65	4.98	11.63	....	....	7.56	12.00	....	....	7.80	Feb 23	Blacksburg	Richmond Guano Co.	Richmond, Va.
437	Seneca High Grade Acid Phos.	15.29	14.33	.97	9.49	3.87	13.36	....	....	8.68	13.00	....	....	8.45	Mar 5	Seneca	Seneca Fert. Co.	Seneca, S. C.
451	Star Brand Diss. Bone	11.69	15.07	2.53	9 27	3.27	12.54	....	....	8.15	12.00	....	....	7.80	Feb 26	Cowpens	Va.-Carolina Chem. Co.	Richmond, Va.
409	Stonewall Diss. Bone	12.84	15.49	1.66	10.96	2.87	13.83	....	....	8.99	12.00	....	....	7.80	Feb 23	Simpsonville	" "	"
423	Stonewall Diss. Bone	12.42	16.94	.77	9.99	6.18	16.17	....	....	10.51	13.00	....	....	8.45	Feb 27	Greers	" "	"
192	Stono Diss. Bone	13.70	12.98	1.33	8.75	2.90	11.65	....	....	7.57	12.00	....	....	7.80	Feb 9	Abbeville	" "	"
434	Strother's Acid Phos.	13.76	15.02	1.10	11.30	2.62	13.92	....	....	9.05	13.00	....	....	8.45	Mar 5	West Union	W. A. Strother	West Union, S.C.
405	Swift's Chattahooche Acid Phos	11.72	14.48	2.06	6.37	6.05	12.42	....	....	8.07	12.00	....	....	7.80	Feb 20	Honea Path	Swift Fert. Works.	Atlanta, Ga.
369A	Swift's Cap. High Grade "	14.05	16.04	2.21	9.85	3.98	13.83	....	....	8.99	13.00	....	....	8.45	May 22	Greenwood	" "	"

TABLE II. Acid Phosphates, Without Potash.—Continued.

Sample No.	Brand of Fertilizer	Moisture	FOUND								GUARANTEED				Date Sampled	Sampled At	Manufacurer	Manufactured At
			Phosphoric Acid					Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per ton.				
			Total	Insoluble	Soluble	Reverted	Available											
295	Woods & Malone's Acid Phos.	13.51	14.71	1.36	10.26	3.09	13.35	....	....	8.68	12.00	....	....	7.80	Mar 9	Luray	Woods & Malone	Savannah, Ga.
242	Wulbern's Diss. Bone	13.40	15.42	2.67	8.64	4.11	12.75	....	....	8.29	13.00	....	....	8.45	Feb 3	Manning	Va.-Carolina Chem. Co.	Richmond, Va.
420	Richmond Diss. S. C. Phos.	12.71	13.62	.73	6.55	6.34	12.89	....	....	8.38	12.00	....	....	7.80	Feb 27	Greers	Richmond Guano Co.	"
449	Cherokee Diss. Bone	13.64	15.43	2.42	9.67	3.34	13 01	....	....	8.46	13.00	....	....	8 45	Mar 19	Anderson	Va.-Carolina Chem. Co.	"
458B	Swift's Cap. High Grade Acid P	12.33	17.32	2.64	8.51	6.17	14.68	....	....	9.54	13.00	....	....	8.45	May 15	Anderson	Swift Fertilizer Works	Atlanta, Ga.

TABLE III. Acid Phosphates, With Potash.

Sample No.	Brand of Fertilizer	Moisture	FOUND								GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid					Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
			Total	Insoluble	Soluble	Reverted	Available											
199	Am. F. Co's. Diss. Bone & Pot..	13.46	11.31	.27	7.55	3.49	11.04	....	2.13	9.09	10.00	....	2.00	8.30	Feb 17	Greenwood....	American Fert. Co.......	Norfolk, Va.
364	Ashley Acid Phos..	13.04	14.28	1.16	9.77	3.35	13.12	....	1.86	10.20	10.00	....	2.00	8.30	Apr 2	Santuc.........	Va.-Carolina Chem. Co..	Richmond, Va
85	Ashepoo Potash Acid Phos	10.36	13.84	.55	10.62	2.67	13.29	....	1.91	10.36	11.00	....	1.00	8.05	Feb 21	Gaffney........	Ashepoo Fert. Co........	Charleston, S. C.
69	Augusta Acid Phos.............	14.29	13.19	1.18	9.19	2.82	12.01	....	.94	8.65	12.00	....	1.00	8.70	Feb 8	Leesville	Augusta Guano Co.......	Augusta, Ga.
60	Baldwin F. Co's. Acid Phos.....	17.27	13.41	.43	10.62	2.36	12.98	....	1.58	9.86	11.00	....	1.00	8.05	Feb 7	Batesburg	Va.-Carolina Chem. Co..	Richmond, Va.
444	Bowker's Diss. Bone and Pot...	14.45	11.90	.90	6.97	4.03	11.00	....	2.00	8.95	10.00	....	2.00	8.30	Mar 14	Verdery........	Bowker Fert. Co.........	Savannah, Ga.
402	Brock's Acid Phos. and Potash.	11.37	13.69	1.47	9.89	2.33	12.22	....	1.19	9.01	11.00	....	1.00	8.05	Feb 20	Honea Path....	Brock Fert. Co..........	Honea Path, S.C.
72	Cherokee Acid Phos...........	12.24	13.62	1.15	7.83	4.64	12.47	....	1.07	9.07	11.00	....	1.00	8.05	Feb 15	Jonesville......	Va.-Carolina Chem. Co..	Richmond, Va.
421	Chicora Acid Phos.............	11.58	13.20	1.60	8.98	2.62	11.60	....	2.39	9.69	10.00	....	3.00	9.20	Feb 22	Greers.........	" "	"
493	Chicora Acid Phos.............	12.30	13.88	1.93	9.63	2.32	11.95	....	2.01	9.58	12.00	....	2.00	9.60	Mar 16	Lancaster......	" "	"
264	Chicora Acid Phos.............	12.41	13.30	1.52	9.66	2.12	11.78	....	4.36	11.58	10.00	....	4.00	10.10	Feb 15	Appleton.......	" "	"
78	Columbia Bone and Potash	13.23	12.92	.70	6.95	5.27	12.22	....	1.86	9.62	10.00	....	2.00	8.30	Feb 16	Spartanburg...	Columbia Guano Co.....	Norfolk, Va.
413	Columbia Acid Phos...........	14.00	13.05	.74	8.06	4.25	12.31	....	1.05	8.95	11.00	....	1.00	8.05	Feb 24	Gray Court....	Va.-Carolina Chem. Co..	Richmond, Va.
494	Columbia Acid Phos...........	14.52	13.20	1.10	9.49	2.61	12.10	....	2.06	9.72	12.00	....	2.00	9.60	Mar 11	Lancaster......	" "	"
277	Compound Standard............	14.43	11.31	.51	9.01	1.79	10.80	....	2.25	9.05	10.00	....	2.00	8.30	Feb 23	Millett.........	Savannah Guano Co.....	Savannah, Ga.
482	Eureka Acid Phos	15.18	12.23	.82	9.72	1.69	11.41	....	2.24	9.43	10.00	....	2.00	8.30	Mar 2	Whitmires....	Va.-Carolina Chem. Co..	Richmond, Va.
442	Ga. Chem. Works Acid Phos....	13.20	13.59	.27	8.46	4.86	13.32	....	.89	9.46	12.00	....	1.00	8.70	Mar 14	Parksville	Georgia Chem. Works...	Augusta, Ga.
278	Ga. Chem. Works Bone & Pot..	14.84	11.22	.87	6.88	3.47	10.35	....	2.24	8.74	10.00	....	2.00	8.30	Feb 23	Millett.........	" "	"
408	Imperial Acid Phos............	12.01	14.05	1.96	8.61	3.48	12.09	....	1.42	9.14	11.00	....	1.00	8.05	Feb 23	Fountain Inn..	Va.-Carolina Chem. Co..	Richmond, Va.
452B	Imperial Acid Phos	13.68	11.54	1.18	6.65	3.71	10.36	....	2.40	8.89	10.00	....	2.00	8.30	Mar 24	Belton.........	" "	"
488	Leroy Springs Acid Phos	13.66	14.53	.99	10.62	2.92	13.54	....	2.35	10.92	12.00	....	2.00	9.60	Mar 13	Chester........	" "	"
293	Patapsco X. X. Acid Phos.......	13.80	12.74	1.43	7.01	4.30	11.31	....	3.75	10.73	10.00	....	4.00	10.10	Mar 12	Garnett........	Patapsco Guano Co......	Baltimore, Md.
483	Royal Acid Phos...............	14.37	13.30	.64	10.48	2.18	12.66	....	2.34	10.34	10.00	....	4.00	10.10	Mar 10	Chester........	Va.-Carolina Chem. Co..	Richmond, Va.
297	So. Fert. Co's 4 per ct. A. Phos.	14.00	11.89	1.04	8.61	2.24	10.85	....	2.57	9.37	8.00	....	4.00	8.80	Mar 19	Ulmers	" "	"
418	Star Brand Acid Phos..........	11.95	14.72	1.94	6.56	6.22	12.78	....	1.52	9.68	10.00	....	2.00	8.30	Feb 26	Duncans.......	" "	"
426	Star Brand Acid Phos..........	12.41	14.55	1.71	9.63	3.21	12.84	....	1.12	9.35	11.00	....	1.00	8.05	Feb 27	Taylors........	" "	"

TABLE III. Acid Phosphates, With Potash.—Continued.

Sample No.	Brand of Fertilizer	Moisture	FOUND								GUARANTEED				Date Sampled	Sampled At	Manufacturer	Manufactured At
			Phosphoric Acid															
			Total	Insoluble	Soluble	Reverted	Available	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
360	Stono Acid Phos................	11.01	12.26	.81	7 43	4.02	11.45	....	5.82	12.68	10.00	....	4.00	10.10	Mar 22	Ridgeway.	Va.-Carolina Chem. Co..	Richmond, Va.
404	Swift's Atlanta Acid Phos.......	9.83	12 38	1.53	5.14	5.71	10.85	....	1 14	8.08	11.00	....	1 00	8 05	Feb 20	Honea Path....	Swift Fertilizer Works..	Atlanta, Ga.
368	Swift's Atlanta Acid Phos.......	12.95	14 71	1.88	7.42	5.41	12.83	....	1.13	9 36	11.00	....	1 00	8.05	May 22	Greenwood....	" "	"
281	Wando Acid Phos	12.96	13.15	.79	9.35	3 01	12 36	....	1.70	9.56	11 00	....	1 00	8 05	Mar 1	Creston........	Va.-Carolina Chem. Wks	Richmond, Va.
267	Wulbern's Acid Phos...........	12 57	13.46	1.84	8 88	2.74	11 62	....	1.19	8.62	11.00	....	1.00	8.05	Feb 16	Allendale......	" "	"

TABLE IV. Cotton Seed Meals.

Sample No.	MANUFACTURER OR DEALER	Moisture	FOUND									GUARANTEED				Date Sampled	MANUFACTURED AT
			PHOSPHORIC ACID														
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Available Phos. Acid	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton		
366	Abbeville Oil and Fert Co	6.05	2.52	.19	1.38	.95	2.33	7.34	8.91	1.64	23.04	......	7.50	......	16.87	Apl. 4	Abbeville, S. C.
475 A	Atlantic Cotton Oil Co	5.49	2.87	.20	1.33	1.34	2.67	7.45	9.05	1.60	23.54	......	7.50	......	16.87	Mar 26	Bennettsville, S. C.
381	Atlantic Cotton Oil Co	6.83	3.20	.17	1.25	1.78	3.03	7.33	8.90	1.75	23.57	......	7.50	......	16.87	Feb. 16	Bennettsville, S. C.
470	Campobello Oil Mill	6.13	2.48	.22	1.41	.85	2.26	7.42	9.01	1.63	23.20	......	7.00	......	15.75	Mar. 14	Campobello, S. C.
367	Clinton Oil and Mfg. Co	7.88	2.58	.20	1.02	1.36	2.38	7.57	9.19	1.67	23.73	......	7.50	......	16.87	Apl. 13	Clinton, S. C.
369	Dillon Oil Mill	5.92	3.43	.19	1.32	1.92	3.24	7.08	8.60	1.84	23.11	......	7.50	......	16.87	Feb. 8	Dillon, S. C.
377	Florence Oil Mill Co	8.12	2.61	.18	.88	1.55	2.43	6.26	7.60	1.70	20.21	1.50	7.00	1.00	17.62	Feb. 9	Florence, S. C.
184	McCormick Cotton Oil Co	6.87	2.12	.20	1.27	.65	1.92	6.94	8.43	1.62	21.67	......	7.50	......	16.87	Feb. 7	McCormick, S. C.
188	Ninety-Six Oil Mill	8.06	2.30	.19	1.29	.82	2.11	6.97	8.46	1.66	21.90	......	7.50	......	16.87	Feb. 8	Ninety-Six, S. C.

TABLE V. Miscellaneous.

Sample No.	Brand of Fertilizer	Moisture	FOUND									GUARANTEED			Date Sampled	Sampled At	Manufacturer or Importer	Address
			Phosphoric Acid															
			Total	Insoluble	Soluble	Reverted	Available	Nitrogen	Equivalent to Ammonia	Potash Soluble in Water	Relative Com. Value per Ton	Ammonia	Potash Soluble in Water	Relative Com. Value per Ton				
288	Cerealite Top Dressing.......	8.08	....	....	....	....	....	7.61	9.24	3 86	25.65	9.00	2.50	23 85	Mar 8	Eastover.....	Home Fert. Chem. Works.	Baltimore, Md.
217	Fish Scrap....................	6.40	7 64	1.88	.49	5.27	5.76	9.36	11 37	.....	31.03	10.00	.....	24.00	Jan 16	Martin's P'nt	Moloney & Carter	Charleston, S. C.
221	Dried Blood......	....	....	....	....	....	....	13.43	16.30	.....	40 75	16.00	.....	40.00	Jan 18	Allendale....	Read Phos. Co............	"
197	Muriate Potash..............	....	....	....	....	....	....	.....	.....	51.09	45.98	.....	50.00	45.00	Feb 14	Newberry....	Va.-Carolina Chem. Co....	Richmond, Va.
351	Muriate Potash.............	....	....	....	....	....	....	....	.....	50.18	45.16	.....	50.00	45.00	Mar 20	White Oak...	Imperial Fert. Co..........	Charleston, S. C.
428	Muriate Potash..............	....	....	....	....	....	....	.....	.....	52 15	46.94	.....	55.00	49 50	Feb 28	Liberty......	G. Ober & Sons Co........	Baltimore, Md.
477 A	Muriate Potash..............	....	....	....	....	....	....	....	.....	50.38	45.34	.....	50.00	45 00	Mar 27	Bennettsville	Atlantic Cotton Oil Co.....	Bennettsville, S. C.
476 A	Nitrate Soda................	....	....	....	....	....	....	15.61	18.96	.....	44 56	18.00	.....	42.30	Mar 27	"	" " "	"
19	Nitrate Soda................	....	....	....	....	....	....	15.73	19 10	.....	44.89	18.00	.....	42 30	Jan 17	Winnsboro ..	Ashepoo Fert. Co..........	Charleston, S. C.
171	Nitrate Soda................	....	....	....	....	....	....	15.61	18.96	.....	44 56	18.00	.....	42.30	Jan 29	Anderson. ...	Va.-Carolina Chem. Co....	Richmond, Va.

TABLE VI. Kainits.

Sample No.	Importer or Dealer	Found		Guaranteed		Date Sampled	Sampled At	Importer or Dealer	Address
		Potash Soluble in Water	Relative Com. Value per Ton	Potash Soluble in Water	Relative Com. Value per Ton				
64	Georgia Chemical Works.......	12.60	11.34	12.00	10.80	Feb. 7	Ridge Spring......	Georgia Chemical Works..........	Augusta, Ga.
473A	Read Phosphate Co.............	12.94	11.65	12.00	10.80	Mar. 23	Dillon	Read Phosphate Co................	Charleston, S. C.

55.

BULLETIN 55. **OCTOBER, 1900.**

South Carolina Agricultural Experiment Station.

Clemson Agricultural College.

(*S. C. A. & M. COLLEGE.*)

FEEDING RICE MEAL TO PIGS.

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Summary of Results.

FEEDING RICE MEAL TO PIGS.

When fed with milk, rice meal has a feeding value equal to that of corn meal.

Pigs, six months old, made an average gain of 1.72 pounds per day for 61 days when fed on rice meal and skim milk at the ratio of one pound of meal to four pounds of milk. The lot fed on corn meal and milk at the same ratio made an average gain of 1.66 pounds for 61 days.

It took 2.48 pounds of rice meal and 9.91 pounds of skim milk to make one pound of gain.

It took 2.57 pounds of corn meal and 10.28 pounds of milk to make one pound of gain.

One pound of gain cost 3.84 cents when rice meal was fed and 4.63 cents when corn meal was fed.

Feeding Rice Meal to Pigs.

By C. M. CONNOR, Assistant Agriculturist.

It has been known for some time that rice meal was valuable for fattening hogs, but very little data could be found on the subject.

The object of the experiment was to find the feeding value of rice meal, using corn meal as a standard. As corn meal gives the best results when fed with skim milk, it was thought best to feed the rice meal with skim milk. The milk fed to each lot being of the same composition and fed in the same ratio to each lot, it may, in a large measure, be eliminated in comparing the feeding value of the rice meal and corn meal.

On June 15th six Berkshire pigs, five months old, of uniform size and weighing about 90 pounds each, were selected for this experiment. They were weighed and divided into two lots, putting one sow and two barrows in each lot. Pigs Nos. 7 and 8 were sows.

Lot 1 was fed on corn meal and skim milk, one pound of meal to four pounds of milk. Lot 2 was fed on rice meal and milk, one pound of meal to four pounds of milk.

The rice meal is a by-product of the rice mills and consists largely of rice flour, rice polish and rice bran. As yet the mills have no uniform way of putting it on the market, and in order that the reader may understand what we mean by rice meal as used in this experiment, we might say that it is all the by-product obtained in cleaning the rice grain for the market. Its chemical analysis shows that it has about the same amount of protein, carbohydrates and fat as corn meal.

The corn used was grown on the farm and was of a large white variety.

The milk was separator skim milk and contained only a trace of fat.

As the pigs had been on full feed before selecting them for the experiment, they were given all they would eat within a few days after dividing them into lots. They were fed until July 3rd as a preliminary period, and to see how much of each mixture they would require for a full feed. The meal in both cases was fed mixed with the milk. They were given all they would clean up, which was four pounds of meal and 16 pounds of milk per head at the beginning of the experiment; this was increased as they required it.

The lots were weighed on July 3rd and 4th, and the average of the two weights was taken as the weight for July 3rd. The weights recorded for the last day of the experiment are the average of the last two days.

The pens were 20 x 40 feet, with plenty of shade, so that the pigs would not suffer from the heat of the sun.

Water was given at noon each day, but they drank very little.

The lots were fed as stated above for 39 days, giving each lot the same amount of meal and milk, as they continued to eat about the same.

The following table gives the results for the first period:

TABLE I.—First Period, 39 Days.

LOT NO.	No. of Pig.	Weight of Pigs.		Gain.	Pounds of meal consumed.	Pounds of milk consumed.	Value of meal consumed.	Value of milk consumed.	Total value of food consumed.	Av. cost per pound of gain, cents.	Av. gain per head, per day, pounds.
		July 3	Aug. 11								
Lot No. I.	1	84 5	157 5	73.0							1.87
Corn meal, one part..	3	94.5	163 0	68.5							1.76
Skim milk, four parts	7	77 5	152.5	75 0							1.92
Total............		256·5	473.0	216 5	484 5	1938	$4.84	$3 88	$8.72	4.02	5.55
Lot No. II.	2	86 0	165.5	79.5							2.04
Rice meal, one part..	6	98.5	163 5	65.0							1.67
Skim milk, four parts	8	76.0	146.0	70.0							1 80
Total............		260 5	475.0	214 5	484.5	1938	$3.63	$3.88	$7.51	3 49	5.51

The rations were then changed, lot I getting rice meal and milk, and lot II corn meal and milk, at the same rate as before.

After a preliminary period of nine days the lots were weighed on August 21st and 22nd, and the average taken as the weight for August 21st.

After the change was made the lots continued to eat about the same, so the amount given each lot was the same during this period.

The following table gives the results for the second period:

TABLE II.—Second Period, 22 Days.

LOT NO.	No. of Pig.	Weight of Pigs.		Gain.	Pounds of meal consumed.	Pounds of milk consumed.	Value of meal consumed.	Value of milk consumed.	Total value of food consumed.	Av. cost per pound of gain, cents.	Av. gain per head per day, pounds.
		Aug. 20	Sept. 11								
Lot I.	1	169.0	205.0	36.0							1.64
Rice meal, one part..	3	175.0	208.0	33.0							1.50
Skim milk, four parts	7	162.5	193.5	31.0							1.41
Total..........		506.5	606.5	100.0	294.5	1178	$2.21	$2.36	$4.57	4.57	4.55
Lot II.	2	173.5	200.0	26.5							1.20
Corn meal, one part..	6	177.5	209.5	32.0							1.45
Skim milk, four parts	8	159.0	187.0	28.0							1.27
Total............		510.0	596.5	86.5	294.5	1178	$2.94	$2.36	$5.30	6.13	3.92

In getting the value of the food consumed, corn meal was valued at $20.00 per ton; rice meal at $15.00 per ton, and skim milk at 20 cents per 100 pounds. The price for the corn meal and rice meal was the market price at the time.

By comparing tables I and II it will be noticed that each lot made about the same gain in the first period, but during the second period the corn meal fed lot did not make as rapid gain as did the rice meal fed lot. The cheapest and greatest gain was made during the first period.

The difference in the cost of food makes a difference of about one-half per cent. in the cost per pound of gain in favor of the rice meal during the first period. It seems also that the rice meal has a feeding value equal to the corn meal, but during the second period the rice meal seems to have a feeding value greater than the corn meal.

The following table gives the results for the entire period of 61 days:

TABLE III.—61 Days.

	No. of p'ds of food consumed.		Value of food consumed.			No of pounds of gain.	Cost of one pound of gain cents.	Av. gain per lot per day.	Av. gain per head per day.	Food req'd for 1 pound of gain.	
	Meal.	Milk.	Meal.	Milk.	Tot'l					Meal.	Milk.
Rice meal, 1 part Skim milk, 4 parts	779.0	3116	$5.84	$6.23	$12.07	314.5	3.84	5.16	1.72	2.48	9.91
Corn meal, 1 part. Skim milk, 4 parts	779.0	3116	$7.79	$6.23	$14.02	303.0	4.63	4.97	1.66	2.57	10.28

The results as shown by the above table are for the two periods combined. The object of this was to eliminate as far as possible the individuality of the animals used in the experiment. It is well known that some animals make better use of their food than others.

The results thus combined show that one pound of gain can be produced for 3.84 cents with rice meal and milk, while one pound of gain will cost 4.63 cents when corn meal and milk is fed. They also show that rice meal has a feeding value equal to, if not greater, than that of corn meal.

It has been noticed by feeders that the use of rice meal for fattening hogs had a tendency to weaken the intestines of the hog, but no data could be collected on the subject, as the pigs were not fed on rice meal for the whole time.

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BULLETIN 56. **OCTOBER, 1900.**

South Carolina Agricultural Experiment Station.

Clemson Agricultural College.

(*S. C. A. & M. COLLEGE.*)

WHEAT.

I. *Comparison of Varieties.*
II. *Quantity of Seed per Acre.*
III. *Experiment With Nitrogen.*
IV. *Home Manures.*
V. *Commercial Fertilizers.*
VI. *Tillage.*

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*Engaged in Fertilizer Analyses.

Experiments with Wheat--1900.

J. S. NEWMAN and J. S. PICKETT.

In these experiments all practical details were conducted by Mr. J. S. Pickett, Experiment Station Foreman.

SOME PRACTICAL SUGGESTIONS.

Owing to the very general interest now manifested in wheat culture in this State, a few practical hints suggested by experiments, experience and observation, covering a period of more than forty years, are here given.

Character of Soil.—Wheat delights in a comparatively compact soil, and hence selection of such soils should be made, where available, for this crop.

Thorough drainage is necessary for best results. Many soils are sufficiently drained naturally. Clay loam is to be preferred. Sandy loam underlaid by clay subsoil will give good results, especially if the clay is broken by using a subsoil plow behind the turn plow as the land is broken.

If sandy soil must be used, it should be rendered compact by the incorporation of an abundant supply of humus, or in the absence of this, by heavily rolling at the time of sowing and again in early spring. If practicable, a heavy crop of peas should be grown upon the land intended for wheat. Except upon stiff, clayey soils the crop of peas should be harvested for hay,since turning them under would render sandy soils too porous for this crop.

Preparation of the Soil.—Satisfactory crops of wheat cannot be reasonably expected upon poorly prepared soil. Deep and thorough preparation, involving subsoiling if necessary, and a very complete pulverization of the surface, will invariably be followed by increased production. See the results of the tillage experiment in this bulletin.

Time to Sow.—Success in wheat culture depends in a large measure upon properly guarding against its enemies. If sown early enough for the seed to vegetate before frost, the plants are liable to the attack of the Hessian fly. This fly deposits its eggs upon the leaves. As soon as these hatch the larvæ crawl down toward the bud and there live upon the juices of the plant, often destroying the crop. To avoid this, the grain should not be sown until the usual season for the first frost. If sown earlier it should not appear above ground before frost.

The next danger is from winter freezing. If the seed are sown late upon poorly prepared soil or where the drainage is imperfect the free water in the surface freezes, expands and lifts up the surface and breaks the roots of the plants.

If early varieties are sown too early and spring weather is favorable for growth before danger of frost is over, the wheat joints, forming hollow stems, which burst under the effects of a late frost, causing either death or serious injury to the plants.

SMUT.—All varieties are liable to the attack of "stinking smut," unless all fungous germs which may be attached to the seed are destroyed. This is done either by soaking the seed before planting in a solution of blue stone or copper sulphate (the same chemical which is used in the fungicide, "Bordeaux mixture," in spraying fruit trees and vines). One pound of blue stone dissolved in water will treat five bushels of wheat. If this solution is made too strong, or the seed exposed to it too long, there is danger of injury to the germ of the grain. Hot water treatment is equally as effective and less liable to injure the germ of the grain.

RUST.—If late varieties are sown, and very warm, moist weather precedes the ripening of the grain, the blades and stems of the wheat become affected with a parasitic fungus known as rust. Early ripening varieties are less liable to this disease.

DEPTH TO COVER THE SEED.—Experiments have demonstrated that seed covered deeper than three inches vegetate feebly, if at all. The vitality of the plant is weakened and sometimes destroyed by its struggle in overcoming the resistence of such thickness of soil.

Plants from deeply planted seed are more injured by the freezing of the surface during winter than those from shallow planted seed.

The wheat plant has two distinct sets of roots, viz.: The coronal and seminal systems. Our soil seldom freezes deeper than three inches. If the seminal roots are below the frost line and the coronal above it, the latter are lifted by the expansive force of the ice, while the seminal, being below, are held in position, and the connection between the two severed. If the seed are covered very shallow, both sets of roots will be in the frozen part of the soil and will both be lifted together.

Fertilizers.—If wheat is sown upon land deficient in organic matter, it is wise to use a complete fertilizer, containing nitrogen, phosphoric acid and potash.

If it follows a legume, such as peas or clover, the nitrogen may be omitted, and if the soil contains much clay potash may not be needed.

All fertilizers applied to wheat should be sown broadcast during the preparation of the soil and very thoroughly incorporated with it. Excessive use of nitrogen is injurious, causing too succulent growth resulting in rust or lodging, or both.

Cotton Seed Meal as a Source of Nitrogen.—This ferments very actively when mixed with moist soil. If the seed come into contact with it during such fermentation the germ will be injured. It should, therefore, be applied long enough before sowing the wheat to allow this fermentation to pass its most active stage.

If wheat shows an unhealthy appearance in early spring, especially upon sandy lands, an application of seventy-five pounds of nitrate of soda will prove beneficial, provided there is enough phosphoric acid in the soil to co-operate with it to make the grain.

COMPARISON OF VARIETIES OF WHEAT.

Twenty-six varieties were sown Nov. 17th, 1899, 1-10 acre of each. The uniformity of the productiveness of the soil was tested by planting in corn and weighing the product of plots sixteen feet wide over the whole area.

Location.—A plateau upon an elevated ridge.

Soil.—Sandy, with red sandy clay subsoil.

Preparation.—The corn stalks were cut into several pieces each and then turned in together with the small crop of peas Nov. 2d with the Hancock rotary disc plow, which broke the land eight inches deep and turned up some of the subsoil. This was followed by a two-horse disc harrow, which pulverized the broken soil.

The soil being very dry and porous a two-horse iron roller was then used to render it more compact for sowing.

Fertilizer was applied at the rate of 200 ℔s. of 14 per cent. acid phosphate and 50 ℔s. of muriate of potash per acre. This was put in with the wheat, using a two-horse disc harrow. As a light crop of peas had been grown upon the land the two years next preceding, no nitrogenous manure was applied to the wheat.

Time of Sowing.—The wheat was sown broadcast on the 17th Nov., applying at the rate of one measured bushel per acre. The weather was clear and frosty—the land dry and dusty.

The wheat and fertilizer were plowed in together with two-horse disc harrow and this followed by a two-horse iron roller. The object of the latter was to compact the soil and bring moisture to the surface as the wheat was covered very shallow in dust.

Three plots were sown in the Eclipse variety as a check. There were eighteen varieties which produced more than the average production of the Eclipse.

Earliness.—The varieties which have been grown longest in the South were the earliest to ripen.

The earliest, Alabama, has been grown by Mr. Aaron Boggs, near this station, for thirty years without change of seed. The second early, Georgia Flint, was procured from Mr. P. I. Rawl of Boylston, S. C., who has grown it continuously for many years.

Little May and Mediterranean come next, two days later than Alabama and one day behind Georgia Flint. The seed of both Little May and Mediterranean were obtained from the Holloway Seed Co., Dallas, Tex.

All of the other varieties except No. 1176 from U. S. Dep't. of Agriculture ripened from the 11th to the 18th of June. No. 1176 did not ripen until June 28th. It was the only variety attacked by rust.

Treatment of Seed.—All varieties were moistened with a *boiling solution* of *blue stone*, before sowing, to guard against smut. This proved effectual as no smut has been found in any variety.

Seasons were favorable during the spring for the growth and maturing of the wheat until June 12th, after which there was rain almost daily until the 19th.

It will be observed from the tabulated statement which follows that Tuscan Island gave the largest yield and Alabama the second.

Name of Variety.	From Whom Obtained.	Yield Per Acre, Bushels.
Ga. Flint,	P. I. Rawl, Boylston, S. C.	11.95
Little May,	Holloway Seed Co., Dallas, Tex.	10.50
Nicaragua,	Holloway Seed Co., Dallas, Tex.	7.18
Russian Red,	J. W. Walker, Sandy Flat, S. C.	14.00
Eclipse,	T. W. Wood & Sons, Richmond, Va.	10.13
Red May,	T. W. Wood & Sons, Richmond, Va.	15.31
Long grain Amber,	Mark W. Johnson, Atlanta, Ga.	11.96
Tappahannock,	Mark W. Johnson, Atlanta, Ga.	8.43
Red Wonder,	T. W. Wood & Sons, Richmond, Va.	15.11
Fulcaster,	U. S. Dept. of Agr.	15.53
Tuscan Island,	T. W. Wood & Sons, Richmond, Va.	17.26
White Beardless,	T. W. Wood & Sons, Richmond, Va.	11.83
Fultz,	T. W. Wood & Sons, Richmond, Va.	10.46
Beardless Fulcaster,	T. W. Wood & Sons, Richmond, Va	14.91

Eclipse, T. W. Wood & Sons, Richmond, Va.	13.13
Currell's Prolific, T. W. Wood & Sons, Richmond, Va.	13.01
Golden Chaff, T. W. Wood & Sons, Richmond, Va.	11.86
Purple Straw, T. W. Wood & Sons, Richmond, Va.	13.30
Gold Coin, T. W. Wood & Sons, Richmond, Va.	10.16
Harvest King, T. W. Wood & Sons, Richmond, Va.	14.26
Lancaster, T. W. Wood & Sons, Richmond, Va.	15.16
Bearded Fulcaster, T. W. Wood & Sons, Richmond, Va.	14.08
Silver Coin, Mark W. Johnson, Atlanta, Ga.	9 78
No. 1176, U. S. Dept. of Agr.	3.80
Eclipse, T. W. Wood & Sons, Richmond, Va.	10.88
Mediterranean, Holloway Seed Co., Dallas, Tex.	11.06
Red Wonder, J. E. Lewis, Clemson College, S. C.	7.90
Turkish Red, U. S. Dept. of Agr.	12.96
Mixed varieties	9 83
Alabama, Aaron Boggs, Fort Hill, S. C.	16.70

DIFFERENT QUANTITIES OF SEED PER ACRE.

Soil.—Sandy loam with sandy clay subsoil.

Previous Treatment.—This land had been occupied by fertilizer experiments with cotton in 1898 and 1899. The cotton received absolutely clean culture both seasons.

Arrangement of Plots.—The wheat plots were one-eighth acre each and were laid off across the old cotton plots.

Preparation was exactly like that for the varieties except that cotton stalks were plowed under instead of corn stalks and peas.

Fertilizers.—At the rate of 200 ℔s. 14 per cent. acid phosphate and 50 ℔s. muriate of potash were broadcasted and plowed in with the seed on the 17th Nov.

Object.—To compare production from different quantities of seed sown per acre. Quantities used were 2 pecks, 3 pecks, 4 pecks and 5 pecks per acre. Variety, Mediterranean.

RESULTS.

Plots.	Bus. per acre.
1. ½ bushel sown, yielded..	8.5
2. ¾ bushel sown, yielded..	11.8
3. 1 bushel sown, yielded..	13.6
4. 1¼ bushel sown, yielded..	12.8

EXPERIMENT WITH NITROGEN.

Object.—To compare effects of nitrogen from cotton seed meal and nitrate of soda and the latter applied with the seed and as a top dress.

The intention was to use on each plot a constant quantity of phosphoric acid and potash as the equivalent of these ingredients in 200 lbs. of cotton seed meal.

The first plot received cotton seed meal alone, yield..17.5 bus.
The second, phos. acid and potash and nitrate of soda,
all applied with the seed, yield.. .. ..20.8 bus.
The third received only phos. acid and potash, yield..17.6 bus.
The fourth received in addition to phos. acid and potash applied with the seed, nitrate of soda as a top dress, yield.. .. ..19.4 bus.

COMPARISON OF HOME MANURES.

These plots were adjacent to those of the variety tests and were prepared in the same manner, using rotary disc plow, disc harrow and roller. The land was in corn and peas in 1898 and peas alone in 1899. The manures were thoroughly mingled with the soil before the seed were sown.

In plots 5 and 10 the ingredients which were used in making the compost were applied separately.

Two hundred pounds of cotton seed meal are assumed to be equivalent, in contents of plant food, to 600 pounds of cotton seed.

The additional labor of applying the ingredients of the compost separately about equals that of preparing the compost. The Red Wonder variety was sown on these plots at the rate of one measured bushel per acre.

RESULTS.

No. of Plot.	Fertilizers Per Acre.	Yield Per Acre.
1.	600 lbs. green cotton seed	14.9 bus.
2.	200 lbs. cotton seed meal	12.4 bus.
3.	Without manure	11.9 bus.
4.	500 lbs. compost	17.2 bus.
5.	150 lbs. cotton seed 150 lbs. stable manure 150 lbs. acid phos. 50 lbs. kainit	17.6 bus.
6.	600 lbs. cotton seed	14.6 bus.
7.	200 lbs. cotton seed meal	13.1 bus.
8.	Without manure	11.9 bus.
9.	500 lbs. compost	16.2 bus.
10.	150 lbs. cotton seed 150 lbs. stable manure 150 lbs. acid phos. 50 lbs. kainit	13.6 bus.

EXPERIMENT WITH COMMERCIAL FERTILIZERS.

The land on which this was conducted was cultivated in corn and peas in 1898 and in ground peas in 1899. Lime was applied to half the area at the rate of 1,000 lbs. per acre in the spring of 1899. The first five plots occupied the portion to which the lime was applied. The other five occupied the half to which no lime was applied for the ground peas.

PREPARATION.—The land was prepared as for the varieties. Fertilizers were applied Nov. 18th and Red Wonder wheat sown Nov. 20th at the rate of one bushel per acre broadcast.

RESULTS.

No. of Plot.	Fertilizer Per Acre.	Yield Per Acre.
1.	200 lbs. acid phosphate 200 lbs. cotton seed meal 50 lbs. muriate of potash	15.83 bus.
2.	200 lbs. acid phosphate 50 lbs. muriate	14.96 bus.
3.	200 lbs. acid phosphate	16.76 bus.

4.	50 lbs. muriate	13.13 bus.
5.	Without manure	9.96 bus.
6.	Without manure	7.00 bus.
7.	200 lbs. acid phosphate 200 lbs. cotton seed meal 50 lbs. muriate of potash	19.10 bus.
8.	200 lbs. acid phosphate 50 lbs. muriate	19.00 bus.
9.	200 lbs. acid phosphate	14.63 bus.
10.	50 lbs. muriate	9.36 bus.

EFFECTS OF TILLAGE.

Soil.—Sandy loam.

Two plots of ¼ acre each were used.

Previous Treatment.—In 1898 both plots were in cotton. In the spring of 1899 Irish potatoes were planted on both. After the potatoes were harvested the land was sowed to peas, which, owing to severe drouth, made very small growth.

Plot 1 was turned with boy Dixie plow six inches deep and fertilizers sown broadcast and worked into the soil with disc harrow.

On plot 2 fertilizers were sown broadcast and worked in with disc harrow. Plow was not used on this plot. Red Wonder wheat was drilled at the rate of five pecks per acre with Farmers' Favorite wheat drill and the land rolled with a two-horse iron roller.

RESULTS.

No. of Plot.	Fertilizer Per Acre.	Yield Per Acre.
1.	200 lbs. acid phosphate 50 lbs. muriate of potash 80 lbs. nitrate of soda	20.6 bus.
2.	200 lbs. acid phosphate 50 lbs. muriate of potash 80 lbs. nitrate of soda	12.2 bus.

SUMMARY.

1. Results of the variety test indicate that wheat acquires the habit of early ripening when acclimated in the South.

2. Other things being equal, varieties which have become acclimated are to be preferred.

3. One bushel of seed per acre gave better results than either more or less than that quantity.

4. Nitrate of soda applied at the time of sowing the seed (the land having clay subsoil) gave slightly better results than where used as a top-dress, applied in the spring.

5. Cotton seed used as a fertilizer produced an average of two bushels per acre more than the equivalent cotton seed meal.

6. The compost produced only an average of 1 1-10 bus. more than the same material uncomposted.

7. The application of lime to the land for the previous crop seems to have produced no appreciable effect upon the yield of wheat, the increase on the five plots being only 1.55 bus. per acre.

8. Tillage increased the yield 8.4 bus. per acre.

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BULLETIN 57. DECEMBER, 1900.

South Carolina Agricultural Experiment Station.

Clemson Agricultural College.

(S. C. A. & M. COLLEGE.)

FUNGICIDES.

Address all communications to

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*B. F. Robertson, B. S.	Assistant Chemist
J. S. Pickett	Foreman

John N. Hook, Secretary and Librarian.

*Engaged in Fertilizer Analyses.

GENERAL REMARKS.

I. Fungi, bacteria, unfavorable weather and improper treatment cause plant diseases.

II. Diseases caused by fungi in many cases may be treated profitably.

III. The substances applied to plants to prevent diseases are called fungicides.

IV. Bordeaux Mixture is the most important fungicide now known.

V. For special purposes certain fungicides are to be preferred to Bordeaux Mixture.

VI. It is usually more economical to prevent a disease than to treat it after it occurs,—hence we need more information on plant diseases and plant physiology.

Introduction.

Upon the following pages will be found a few of the fungicides that are used in various sections of the United States and elsewhere. No attempt is made to go into a detailed discussion of fungicides, nor to give more formulæ than will really be needed. Variations of the formulæ might have easily been introduced; in fact, it was difficult to keep from doing so. It is thought that the formulæ given will meet all ordinary requirements in South Carolina. For special purposes, special fungicides should be used, but for combatting the general leaf, stem and root infecting fungi it is thought the following formulæ will be sufficient.

The total amount of damages occurring annually as a result of different diseases of plants is difficult to ascertain, but it must aggregate into the hundreds of millions of dollars annually in the United States.

The damage by rust alone, to small grain in Prussia during 1891 has been estimated at nearly fifty millions of dollars. In Australia, during 1890 to 1891, the loss from rust was about twelve millions of dollars. Hence the need for studying plant diseases and their prevention.

WHAT IS A FUNGICIDE?

Bulletin No. 36 of South Carolina Agricultural Experiment Station, written by Dr. A. P. Anderson, gives an interesting and instructive account of fungi which cause diseases of plants. In this connection is given a clear definition of what a fungus is. After reading this account we will be better prepared to take up the heading above. The word fungicide is made up of two parts: *fungi,* the plural of fungus, and *cide,* to kill. A fungicide, therefore, is something that kills fungi. Under this definition a great many substances would be fungicides, but our custom has limited the meaning of the term to such substances as will kill fungi and not kill the host plant. In Bulletin 36 we are told that fungi are plants as truly as oak trees or cotton plants and that their life-history is also very definite. Therefore, a fungicide is a substance which kills one plant and does not kill the other, hence it must be comparatively a rare substance and applied by intelligent hands.

The history of fungicides shows that they were discovered by accident, but that latterly systematic efforts have been put forth to perfect these and to discover new ones.

MANY CHEMICALS HAVE BEEN TESTED.

As a result of careful and systematic efforts nearly all chemicals have been tested as to their efficiency as fungicides. Some are too active; that is, they kill the host plant as well as the parasite. Many are not sufficiently active, that is, they injure neither parasite nor host, and a few, comparatively few, injure the parasite and not the host. The more energetic a substance as a fungicide the more liable is it to prove caustic to the host plant. Copper sulphate (blue stone) is an excellent fungus destroyer, but unfortunately it is also active in destroying flowering plants. Sulphur on the other hand does not prove disadvantageous (except in very large quantities) to flowering plants and is not a very active fungicide. Such facts have been secured only at the cost of valuable time and careful labor.

OTHER POINTS NECESSARY.

A fungicide to be of practical value must also be of moderate cost. This question must always be considered in the matter of advising people to use a fungicide,—sometimes it costs as much to save a crop as it will bring after it has matured. So it often happens that the remedies known to us become valueless, and considerable loss must be sustained to avoid a greater loss in trying to save a crop.

Another point to be considered is the matter of applying the remedy; that is, the labor that is involved in carrying it out. In most cases the labor of applying a fungicide is the item of greatest cost. The thoughtful man will, therefore, seek to reduce the cost of the labor, not by hiring cheaper men (for they are usually the most expensive), but by enabling each man to accomplish the greatest amount consistent with excellent work. The earliest spraying was done with brooms of heath, then improved brooms were used. A second step was the introduction of the syringe, from which our spray pumps evolved, through the hand pump, the bucket pump, the knapsack sprayer and finally the pump operated by an engine. A third step has lately been taken in using compressed air from a cylinder as the operating force. All of these improvements are designed to reduce the cost of applying fungicides without increasing the cost for materials incident to wasting them by complex machinery.

FUNGICIDES DO NOT CURE.

The reader has been informed in regard to what fungi are and how they live. (See Bulletin 36 of this Experiment Station.) From this it is readily deduced that fungicides do not cure a plant disease in the sense that the word cure is used in human medicine,—a fungicide merely prevents a plant from being *attacked* by certain fungi. The fungus mycelium (Bulletin 36, page 6) enters the host plant from the outside, therefore we place upon the epidermis of the host plant a poison (fungicide) which kills the spore or the mycelium but the mycelium once within the host is beyond the reach of the poison (fungicide) and will continue to grow there and reproduce its kind. From this it will be seen that a fungicide does not *cure* but *prevents*. In human medicine there is an adage which says that an ounce of prevention is worth a pound of cure. This is doubly applicable in combatting plant diseases.

WHEN SHALL WE SPRAY?

Since spraying is only a prevention for plant diseases it becomes of prime importance to know when to spray. It is, of course, necessary to anticipate the disease. An orchard that has suffered severely from rust this year will doubtless be attacked again next year. As this fungus attacked the tree in March and April we must anticipate this attack next year and spray just preceding these dates.

The number of times to spray will depend greatly on atmospheric conditions. During dry weather most fungi are not able to infect their host-plants and we say "the disease does not spread." Moist weather brings about good conditions for "fungi to spread" and at the same time frequent rains wash off considerable of the fungicide. Hence we need to spray often during rainy weather and not so frequently during dry weather.

As a general rule we may say that an orchard should be sprayed before the buds open, again after blooms fall and after that at intervals of about ten days. A field, for example of Irish potatoes, of tomatoes, etc., should be sprayed at the first indication of disease and then at intervals of a week or ten days.

HOW TO SPRAY.

Remembering the fact that a fungicide protects the host-plant from being attacked by the parasite fungus we can readily understand why the work must be done thoroughly. Any portion of the leaf or branch not covered with the fungicide is liable to be attacked,—of course the liability of attack is decreased in proportion as the amount of leaf surface not sprayed is decreased. When spraying is done by the ordinary laborer it is necessary that the work be carefully superintended. Such diseases as attack the roots of plants must be prevented by spraying the ground, and in such cases there is evidently no occasion for spraying the foliage.

The best spraying nozzles for treating the foliage and branches are those that reduce the fungicide to the finest mist. The amount of material applied should be just enough to form a fine film over the leaves and branches and it should not be continued until the fungicide drips from the plant.

ARE FUNGICIDES DANGEROUS?

This question has been raised many times, but it is no longer considered in our commercial centres. Sprayed fruits and vegetables being passed regularly by the health officer, but when spraying was first practiced the presence of copper compounds caused some trouble and lead to a careful study of the matter. Dr. L. L. Van Slyke, chemist of the New York Agricultural Experiment Station analized some grapes that had been seized by health authorities in New York. In his report he stated,—"to get an amount of copper that would be regarded serious, if taken at one dose, one would have to eat not less than 3,000 pounds of grapes, skins included, and not less than 500 pounds including stems and berries."

Even on such vegetables as cabbage and cauliflower the rational use of fungicides cannot be considered dangerous but *insecticides* (arsenous preparations) should not be employed after the "flower" begins to form in the cauliflower or after a cabbage head is more than half grown.

LIME.

This material is usually applied in the air-slaked form; the quick-lime being in hard lumps and somewhat caustic to handle. No regular formula can be given for its use. It is simply applied in such a quantity as the superintendent may consider "enough." Dr. Halsted of the New Jersey Experiment station has shown that club-root of cabbage, turnips, ruta-bagas and other plants can be prevented to a large extent by applying about 75 bushels of quick lime per acre. The germ causing club-root, botanically known as *Plasmodiophora brassicae,* passes the interval between the removal of the crop and the further planting in the soil and indeed its entire life is spent under ground.

Damping off, which is caused by a number of fungi, may also be treated more or less succesfully by making a liberal application of slaked lime. It is especially useful in treating damping off in tobacco seed-beds, radish beds, cabbage seed-beds and cauliflower seed-beds. Apply the slaked lime to the soil and work in lightly. Just enough lime should be used to give the bed a light covering.

BLUE STONE SOLUTION.

Copper sulphate and blue vitrol are other names applied to this substance. Its principal use is in treating wheat or other grain for smut. In some instances it gives excellent results, but it has also been known to prove very detrimental to the vitality of the grain so treated. This trouble may be partially obviated by treating the grain with lime water for five minutes immediately after the requisite time (12 hours) for treatment with the blue stone solution has elapsed.

FORMULA I.

Blue stone (copper sulphate)........1 ℔.
Water ....25 gallons.

Dissolve the blue stone in a wooden or earthen vessel (never in an iron). If the blue stone is thrown directly into a barrel it dissolves very slowly, but if suspended just below the surface of the water in coarse wrapping or bagging cloth it dissolves in an hour or two, depending upon the warmth of the water used. A better way is to pour two or three gallons of hot water in a wooden pail and then add the blue stone, stirring the water until the blue stone is dissolved. The most rapid way of dissolving blue stone is to use hot water and powdered blue stone. In large quantities powdered blue stone costs only about a cent per pound more than the blue stone in lump.

Besides the use of blue stone solution in treating smutted wheat it is an excellent fungicide to use in treating fruit trees during the winter and early spring, but as soon as the buds begin to swell it should be used only under special directions. Many diseases of fruit trees, such as heart-wood-rot, peach curl and brown rot of peaches may be treated to advantage during late winter or early spring.

SULPHUR.

This substance is frequently applied. It is used in the form of a powder or what is called flowers of sulphur. An over dose is scarcely possible, hence there are no special directions necessary. All that is necessary is to dust it over the plants affected with mildews, moulds, etc. It is a mild fungicide and not employed extensively in America.

It has been applied at the rate of 1 ounce of sulphur to 5 gallons of water with good effect, but a larger proportion of sulphur would be effective in a greater number of cases. It has also been used as a fungicide in soils to prevent potato scab and other diseases affecting the roots of plants. Its value has been demonstrated repeatedly but the remedy is not sufficiently complete to bring it into general use.

POTASSIUM SULPHIDE.

FORMULA 2.

Potassium Sulphide	1 oz.
Water	2 gallons.

Potassium sulphide (liver of sulphur) dissolves quickly in water and has a peculiar sulphurous odor. This is the most convenient fungicide in the list for home use. It is too costly to be used in extensive work, but for the home garden, flower beds, cold frames, and general purpose fungicide it has many advantages over other substances. It may be applied without much danger from from over dosing, and its odor will prevent any animal from drinking it. Besides its general properties as fungicide it is also useful as an insecticide for thrips, phytops and red spider. On exposure to the air it looses its property as fungicide, hence it should be kept in a closely stoppered bottle until wanted for use and dissolved as needed.

HOW TO APPLY IT.

Potassium sulphide should be dissolved in a wooden vessel and then applied either directly from that or it may be poured into a watering pot or spraying machine and applied from that. The most primitive way of applying is by use of a whisp broom. This does not enable one to apply it evenly nor rapidly. If a watering pot is used the nozzle should be as fine as can be selected and only enough fungicide used to completely moisten the diseased plants. Do not use so much as to make it run off and on the ground. If the soil needs treating as for damping off fungi the solution should be applied directly to the soil.

For use on an extensive scale, as for field purposes, *Sulphur Spray* will be found as efficient and less costly. Potassium-sulphide spraying solution will cost approximately one cent per gallon for spraying solution.

SULPHUR SPRAY.

This fungicide is more frequently used and recommended for insecticidal purposes. It is, however, a good fungicide, especially for mildews and damping-off fungi, but it is necessary to repeat the application at shorter intervals than when the copper compounds are used.

FORMULA 3.

Flowers of sulphur	10 ℔s.
Caustic soda pulverized (98 per cent. 20 ℔s. or) 70 cent	8 ℔s.
Water	1 gallon.

PREPARATION.

Place the flowers of sulphur in a wooden tub large enough to hold 8 to 10 gallons of water. Pour in one gallon of water and mix with the sulphur until all of the sulphur is moistened. Add the caustic soda and keep stirring until all of the soda has dissolved. The mixture becomes very hot, turns brown and becomes liquid; now add enough water to make seven gallons. Strain immediately into jugs or kegs, being careful to close the jugs or kegs with air-tight stoppers. This will keep indefinitely but deteriorates soon if permitted to remain open.

APPLICATION.

If the liquid is to be kept it should be marked plainly "stock solution" "Sulphur Spray." For mildews and fungi of that class use *1 quart* of stock solution to 12 gallons of water. For damping off fungi use *1 pint* of stock solution to 12 gallons of water. Make a thorough application in either case. The greatest expense in the use of this fungicide is the cost of the labor involved in its application. The material in preparing it costing about one-fifth of one per cent per gallon of spraying solution.

BORDEAUX MIXTURE.

This substance is undoubtedly the most excellent fungicide that we have at present. It would be interesting and profitable to review the history of the events leading up to its discovery and also the history leading to its perfection. Such a review would extend this bulletin too much for our present purposes, however, so we will simply consider its preparation.

FORMULA 4.

Copper Sulphate (blue stone)	3 ℔s.
Quick lime	3 ℔s.
Water	25 gallons.

The number of formulæ recommended for the preparation of Bordeaux Mixture is nearly as great as the number of persons writing about it. An absolutely correct formula cannot be given because of a considerable variation in the composition of quick lime, besides this some variation exists in the composition of the copper sulphate.

HOW TO PREPARE THE COPPER SULPHATE.

Pulverized copper sulphate can be obtained at a slightly greater cost than the ordinary lumpy blue stone. This pulverized copper sulphate dissolves in a short time even in cold water. The ordinary lumpy copper sulphate may be dissolved in so short a time, however, that most of it is used in this form. If the solution is needed with as little delay as practicable, three pounds of copper sulphate may be dissolved in three gallons of hot water and this diluted to make the solution of the strength desired.

The favorite method of preparing the copper sulphate solution is to place 3 pounds of it in a coarse sacking or bagging and suspending this just below the surface of twelve and a half gallons of water. In this position it dissolves in an hour or two while it will not dissolve in a day or more if emptied into the same amount of water.

Caution—Iron vessels should not be used in preparing copper sulphate and Bordeaux Mixture. Keep the solution free from sticks, trash or anything that will clog the spraying nozzle.

HOW TO PREPARE THE LIME.

Fresh or quick lime should be used; any air-slaked or rocky lime must be rejected. When lime becomes air-slaked it changes in chemical composition and the result would not be Bordeaux Mixture. Place three pounds of lime in a wooden tub and add enough water to cover. Soon it begins to simmer and grows hot. During the slaking process it should be watched carefully and stirred to allow water to come in contact with all parts. If the water is used up add more to keep the lime covered. When fully slaked it will be a somewhat thick pasty mass. Strain into a barrel through a coarse cloth, which will take out all rocky particles and dilute to twelve and a half gallons.

HOW TO MIX BORDEAUX.

1. With a broad paddle stir the copper sulphate solution. 2. Stir the lime solution. 3. Pour the lime solution into the copper sulphate solution. 4. Stir the mixture thoroughly, preferably back and forth, for one or two minutes. It is now Bordeaux Mixture.

Apply at once. Repeated experiments have lead a number of botanists to come to the conclusion that the mixture after standing 24 to 48 hours is not of sufficient value as a fungicide to pay for its application.

The above way of mixing Bordeaux enables one to apply the mixture before the precipitate has had time to settle, thus doing away with the necessity of an agitator.

ANOTHER WAY.

A very common way of preparing Bordeaux Mixture is: 1. To dissolve three pounds of copper sulphate. 2. Three pounds of lime are slaked and diluted. 3. Mix the copper sulphate solution and lime solution; and 4. Dilute to 25 gallons. Apply. In using this method an agitator attachment to the spraying machine is necessary to keep the precipitate mixed with the water, otherwise most of the Bordeaux will come out during the time that the first half of the solution is being applied and the last half will be nearly clear liquid and of little value as a fungicide.

ON A LARGE SCALE.

When many acres are to be treated a large quantity of copper sulphate is dissolved at the rate of one or two pounds to a gallon of water and this kept as a stock solution. Similarly a large quantity of lime is slaked and kept as a stock solution. If we have 40 pounds of copper sulphate dissolved in 40 gallons of water and 40 pounds of lime in 40 gallons of water, we will take out one pound of copper sulphate every time we take out a gallon of that stock solution and likewise we will take one pound of lime every time we take out a gallon of the lime stock preparation, *provided* we have first stirred each of the stock preparations to make it of uniform condition.

By using the stock preparations every one can modify the details of the manipuiatlons to be best adapted to his special condition. It is better, however, to dilute the copper sulphate solution and lime preparation as much as possible before mixing them. In this dilute condition the desired chemical action seems to go on to better advantage.

HOW TO KEEP QUICK LIME FROM AIR-SLAKING.

The method is very simple,—merely water-slake it and keep it covered with water. In this condition it will keep indefinitely, but we need to know just how much water-slaked lime a certain amount of quick lime makes. A convenient way is to slake say 80 pounds of lime. Then pour exactly 40 gallons of water into a barrel and make a permanent mark to indicate 40 gallon measure. Pour the water out. Strain the water slaked lime into the barrel and add water to bring to 40 gallon mark. Such a barrel may be placed in a protected corner and covered to keep trash out and the water-slaked lime be kept for a long time,—several years. The lime will settle to the bottom in a day or so, and clear water will be above, and so long as the slaked lime is kept under water no change in its chemical composition will take place. When the lime is to be used enough water is added to bring it up to the 40 gallon mark, the material stirred thoroughly to make it of even composition and then every half gallon taken out will contain one pound of lime.

TO TEST BORDEAUX MIXTURE.

There are several methods for testing Bordeaux Mixture so simple that every one ought to determine just how much lime to use in its preparation.

First Test. Insert a bright, clean knife blade into freshly made Bordeaux Mixture for two minutes, draw it out and wipe clean, if the blade has turned coppery or red your mixture needs more lime.

Second Test. Take a saucer full of freshly made Bordeaux

Mixture and breathe your breath over it for one and a half or two minutes; that is, blow your breath over it 25 to 40 times, and if a thin film forms over the surface of the Bordeaux Mixture there is more lime in the mixture than is needed.

Third Test. The Potassium *Ferro*-cyanide Test. Secure one half ounce potassium *ferro*-cyanide from a druggist. Dissolve it in one-half pint of water and keep in a stopped bottle. Label it "Potassium *ferro*-cyanide" and mark it Poison. To test the Bordeaux Mixture, secure a quantity in a white saucer or white plate and drop into this one drop at a time, some of the potassium *ferro*-cyanide solution. If a brownish coloration (precipitate) is formed more lime is needed in the Bordeaux Mixture. The potassium *ferro*-cyanide may be added directly to the barrel of Bordeaux Mixture in place of testing in a white dish, but the probability of making an error is increased, and as a result Bordeaux Mixture containing free copper sulphate might be applied. The amount of damage resulting from the application of improperly prepared Bordeaux Mixture is very small and the amount saved annually in the United States by its application very great.

WHAT IS NEEDED.

1. Copper sulphate.
2. Lime.
3. Two half barrels marked to show twelve and a half gallons.
4. A whole barrel in which to mix the Bordeaux.
5. A spray pump with a vermorel, cyclone or Bordeaux nozzle (usually a spray pump with two lines of hose is most economical.)
6. Potassium *ferro*-cyanide or a knife with a clean, bright blade.
7. A clean china saucer or plate.

CUPRAM

Also called Ammoniacal Copper Carbonate Solution.

For ordinary fungi Bordeaux Mixture is the best we have at present, but it is of little or no value in treating fungi which live in the soil and attack plants in the roots or below the ground level. Sulphur spray is of importance in combatting fungi which grow in the soil, but it soon becomes inert and is not so active as copper compounds. We need, therefore, a fungicide for treating root-rotting and root-attacking fungi. Cupram is a cheap fungicide and one that may be applied to the soil for destroying soil inhabiting fungi.

This fungicide has another advantage over Bordeaux Mixture in that it discolors fruits and foliage only slightly. Enabling one to use it just before marketing his produce or it may be used on plants in a green house or on the foliage of ornamental plants without rendering them unsightly as would Bordeaux Mixture.

FORMULA 5.

Carbonate of Copper	1 ounce
Carbonate of Ammonia	5 ounces
Water	16 gallons

Place the corbonate of ammonia in a wooden pail or tub; sprinkle upon it the copper carbonate and add two quarts of hot water; stir; when the carbonate of ammonia is completely dissolved dilute to 16 gallons and apply at once.

Another method of making the same fungicide is to use ammonia water in place of carbonate of ammonia.

FORMULA 6.

Copper carbonate	3 ounces
Ammonia water (strength 26° B.)	1 pint
Water	1 gallon

In securing the ammonia water care must be exercised to obtain the 26° Beaume strength or to use an increased amount to make up for the deficiency in strength. Pour the gallon of water into a wooden pail; mix with it the one pint of ammonia water; add the copper carbonate slowly, stirring back and forth. Continue to stir until a minute or two after the copper carbonate has been added. If all of the copper carbonate is dissolved add more until a small quantity remains undissolved. Let stand for 10 or 15 minutes, until the undissolved portion settles, then pour the clear liquid into a jug or large bottle; close with an air tight stopper and mark, "*Stock Solution Cupram* (poison.)" The residue after pouring off the clear liquid may be used in preparing more stock solution.

Use one part stock solution to twenty of water for ordinary use and for peach trees, egg-plant, and such other plants that are sensitive to chemical scalding use one part to twenty-five parts of water.

The stock solution will keep for some time in tightly stoppered vessels, but it is better to prepare it on the day it is to be used.

PRICE OF MATERIAL.

It is of value to the man who wishes to spray to know where and approximately for what price chemicals may be obtained.

Like other commercial products there is some variation in the price of these substances, but the following prices are approximately correct:

Ammonia 26° Beaume in 5 pint bottles, per ℔	17c.
Carbonate of Ammonia in 10 ℔ lots, per ℔	15c.
Carbonate Copper in 1 ℔ lots, per ℔	50c.
Caustic Soda, pulverized—	
98 per cent., in 50 ℔ cans, per ℔	10c.
70 per cent., in 50 ℔ cans, per ℔	7c.
Copper Sulphate, in lumps, 10 ℔ lots, per ℔	7c.
Copper Sulphate, pulverized, in 10 ℔ lots, per ℔	15c.
Potassium *Ferro*-cyanide, in 1 oz. lots, per oz.	15c.
Sulphur Flowers, in 10 ℔ lots, per ℔	4c.

If these materials cannot be secured in the nearby markets or drug stores they can be obtained from the large houses such as the Murray Drug Co., Columbia, S. C. The caustic soda used for fungicidal and insecticidal purposes does not seem to be on the market in South Carolina, and may have to be ordered from Jacksonville, Fla., or New York.

General Rules for Preventing Plant Disease.

The following general statements may prove to be of advantage in a general way in preventing the spread of plant diseases:

I. Rotate crops whenever possible.

II. Whenever practicable avoid planting contiguous fields to the same or similar crops.

III. As soon as a crop has been removed destroy any remnants in the field; that is, do not permit volunteer rye, oats, wheat, rice, etc., to remain in the field. Plant the field to some catch crop as cowpeas.

IV. If possible, when a disease appears, remove the diseased plants and spray the remainder.

V. Burn all diseased seed, plants, and fruits and do not throw them on the manure or compost heap.

VI. Seed from diseased plants should not be planted; especially should cotton seed be guaranteed to be from healthy plants.

VII. Avoid passing from a field containing diseased plants to another; do not permit laborers, animals nor tools to pass from a field that contains diseased plants to another.